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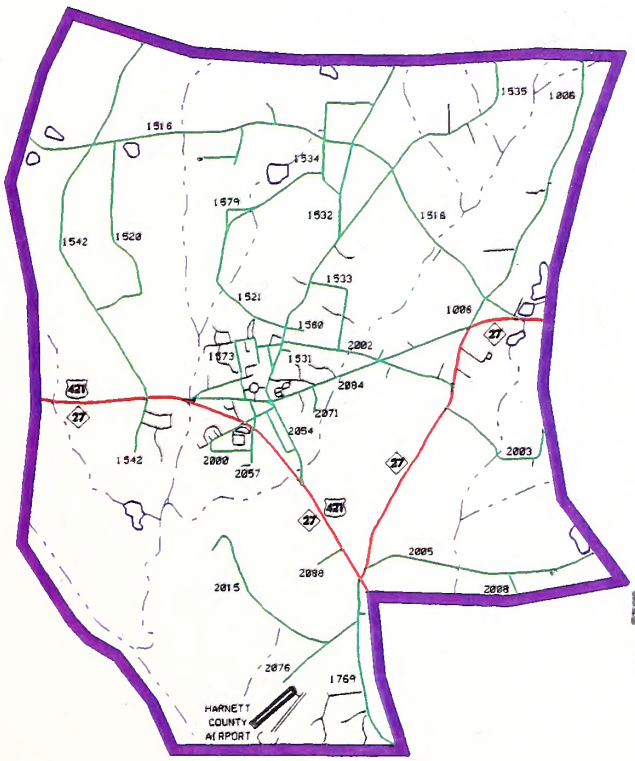
North Carolina Department of Transportation
Statewide Planning Branch
Systems Planning Unit

THOROUGHFARE PLAN TECHNICAL REPORT

for

BUIES CREEK



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Thoroughfare Plan Study Technical Report
for
the Buies Creek Area of North Carolina

Prepared by the:

Statewide Planning Branch
Division of Highways
North Carolina Department of Transportation

In Cooperation with:

Harnett County
Campbell University
The Federal Highway Administration
US Department of Transportation

September 1998

NORTH CAROLINA
PROFESSIONAL
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18446
ENGINEER
MICHAEL S. BRUFF

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Acknowledgments

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Project Technician:	Jocelyn Jones

Special thanks to the officials of Campbell University for their foresight and drive in developing this plan. Also, thanks to the officials of Harnett County for their assistance and commitment to long-range planning.

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EXECUTIVE SUMMARY

Overview

In 1996, officials of Campbell University, Harnett County and the North Carolina Department of Transportation worked together to review the Buies Creek area road system and update the thoroughfare plan for this area. Although recommendations were developed, a final plan was never adopted. This report documents the study to date. At the request of Campbell University, the study has been placed on hold. The study can be re-initiated at the request of the Harnett County Board of Commissioners.

The primary purpose of this report is to present the findings and recommendations of the thoroughfare plan study conducted for the Buies Creek area.

Highlights of the Thoroughfare Plan

Major highlights of the 1996 Buies Creek Area Thoroughfare Plan are outlined below. The recommended improvements are shown in Figure 1. The Proposed Thoroughfare Plan Map is shown in Figure 2.

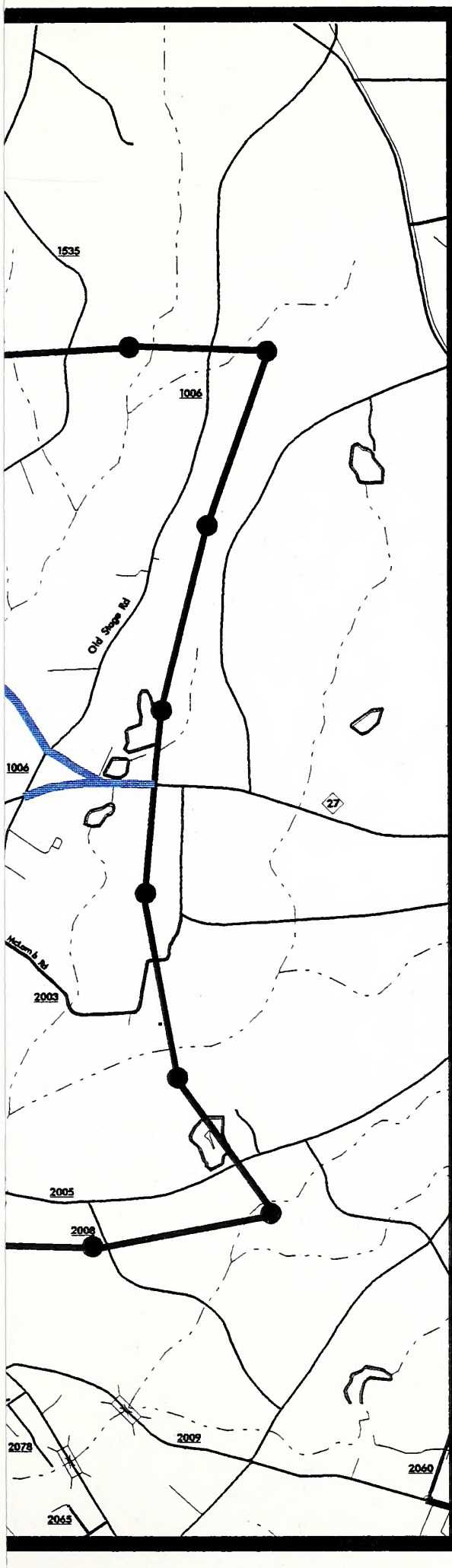
1) Main Street: Widen Main Street to a three-lane section from Leslie Campbell Road to 0.1 mi north of Old Church Road.
2) Leslie Campbell Road: Widen Leslie Campbell Road to a three-lane section to allow for a center lane from US 421/NC 27 to Leslie Campbell Road/Main Street/Marshbanks Street intersection.
3) New Route: Build a new route from the Main Street/Mitchell Road intersection south to intersect the sharp curve of Old Church Road, traversing along the southbound leg of Old Church Road, and ending at an intersection with Leslie Campbell Road to help maintain traffic flow on Main Street.

Refer to Chapter 4 and Appendix A for other recommendations.

Implementation

The North Carolina Department of Transportation (NCDOT) and Harnett County are jointly responsible for the implementation of the thoroughfare plan. Cooperation between the State and Harnett County is of primary concern if the recommendations outlined above are to be successfully implemented.

It is important to note that the recommended plan is based on anticipated growth within the planning area as indicated by past trends and additional information supplied by Harnett County. Prior to the construction of each project, a more detailed study will be required to revisit development trends and to determine the specific location and design requirements for each facility.



LEGEND

	EXISTING	PROPOSED
2 Lanes		
3 Lanes		
4 Lanes		

Planning Area Boundary

June 18, 1997

FIGURE 1

RECOMMENDED IMPROVEMENTS

BUIES CREEK

HARNETT COUNTY
NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

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miles

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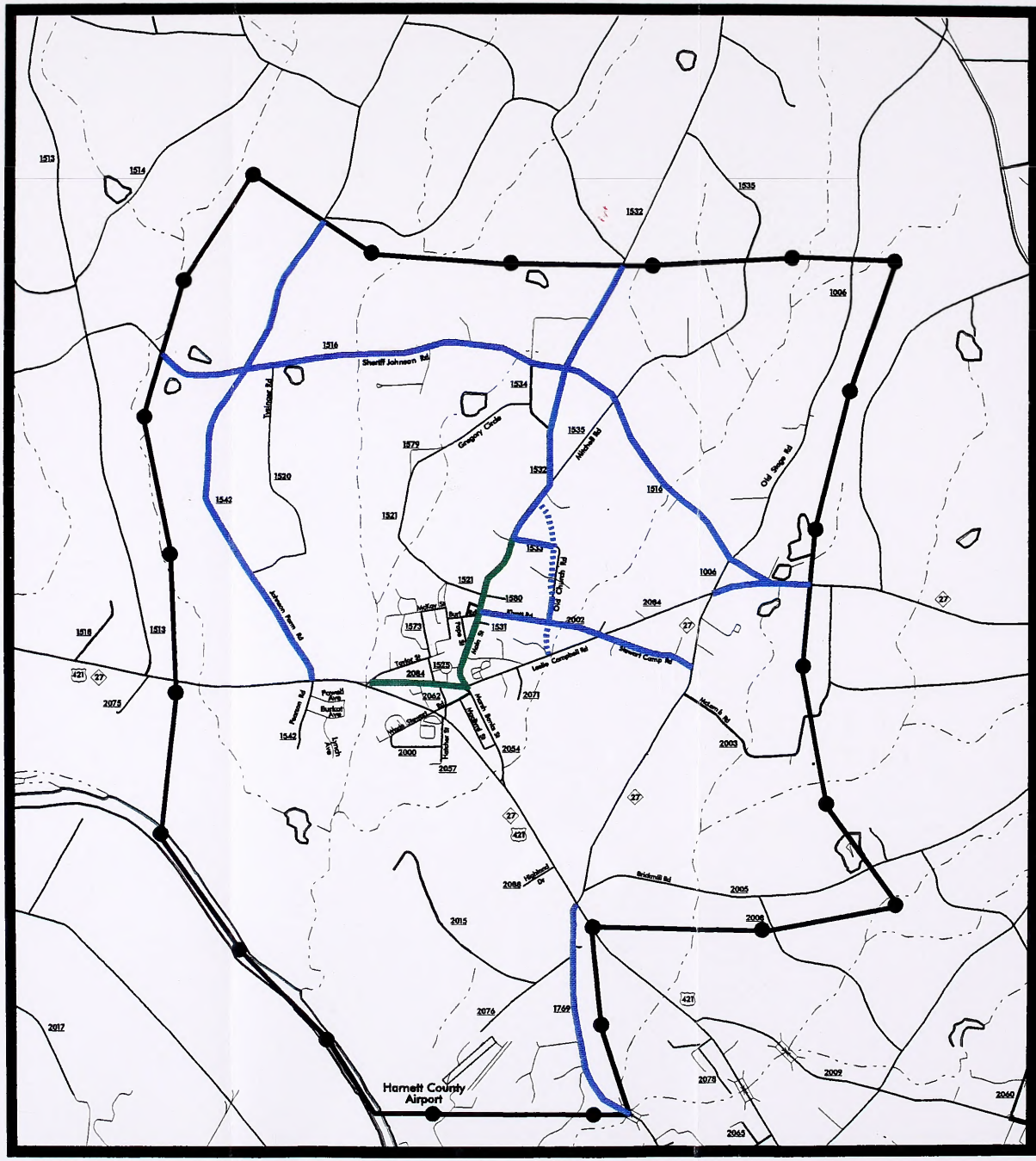
kilometers



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	EXISTING	PROPOSED
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3 Lanes		
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Planning Area Boundary

June 18, 1997

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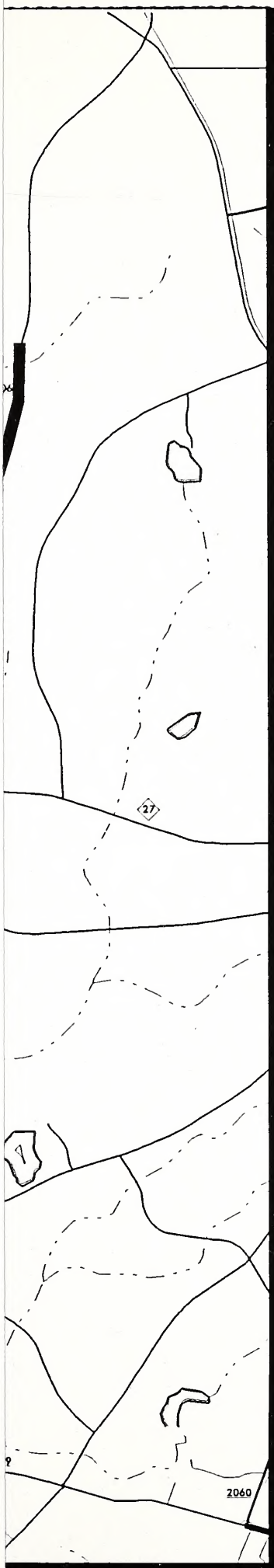

LEGEND

	EXISTING	PROPOSED
INTERSTATE		
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

ADOPTED BY;

HARNETT COUNTY
PUBLIC WORK SESSION August 7, 1996
PUBLIC HEARINGS

RECOMMENDED BY
STATEWIDE PLANNING

N.C. DEPARTMENT OF
TRANSPORTATION

June 18, 1997

FIGURE 2

PROPOSED THOROUGHFARE PLAN

BUIES CREEK

HARNETT COUNTY
NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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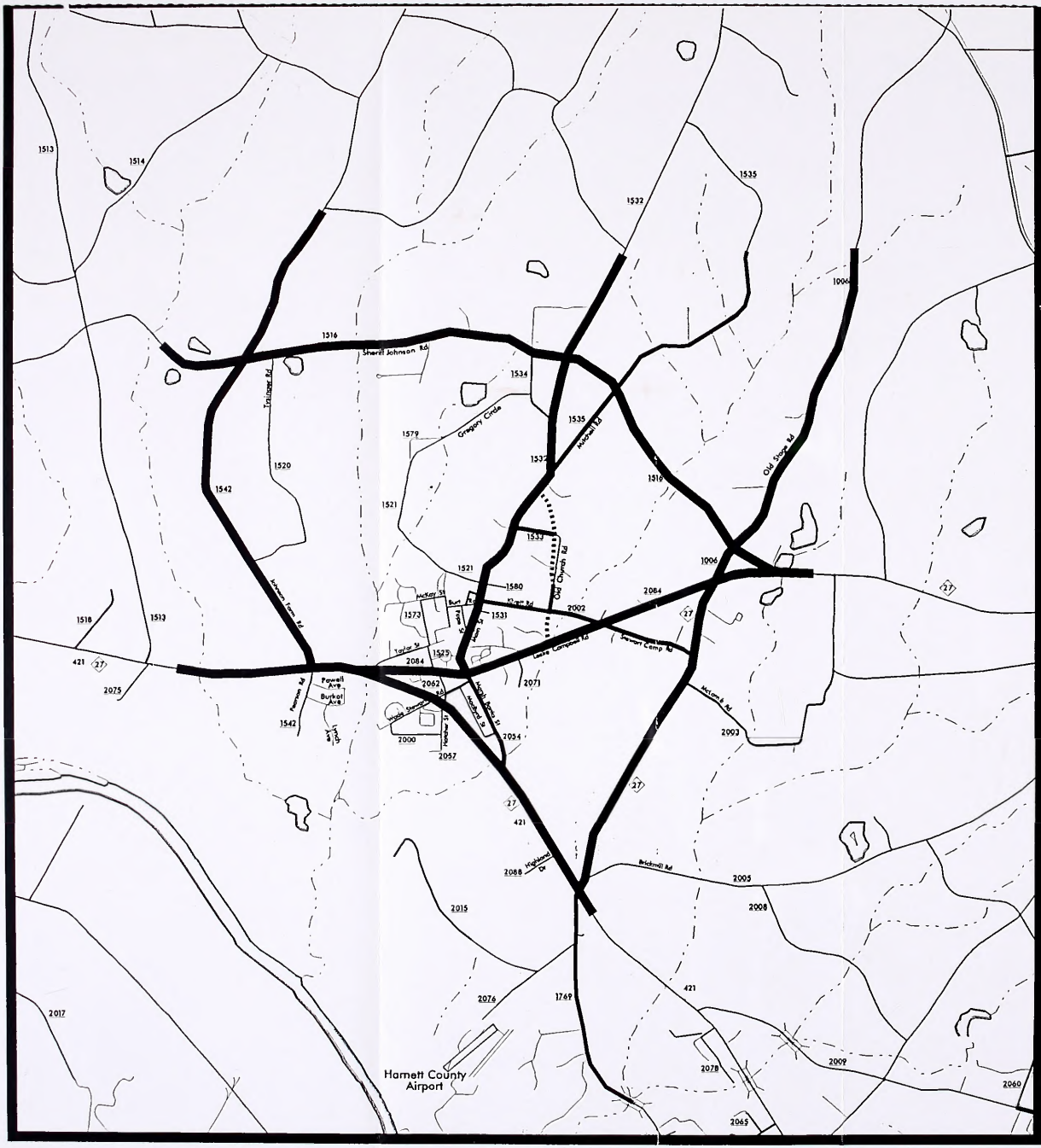

LEGEND

	EXISTING	PROPOSED
INTERSTATE		
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

ADOPTED BY;

HARNETT COUNTY PUBLIC WORK SESSION	August 7, 1996
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June 18, 1997

FIGURE 2

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miles

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kilometers

Chapter 1

INTRODUCTION

The Buies Creek area began when Highland settlers from Scotland concentrated their homesteads along the Upper and Lower Little Rivers in what now make up Harnett and Cumberland Counties. One of the other places they settled was near Buie's Creek.

Many of the people in Harnett are descended from the Campbells (a name common among Highlanders of Argyleshire, Scotland). The Kivetts (one of whom built Kivett Hall of Campbell University) were also descendants of the Campbells.

James Archibald Campbell (born in 1862) created a school on January 5, 1887 in a one-room church house at a place that became the village of Buie's Creek. J.A. Campbell came into this community about 1886, to fill the position of a teacher in the children's school. Z.T. Kivett (who built Kivett Hall of Campbell University) helped to expand the children's school into Buies Creek Academy. There were only twenty-one students at the time.

In 1925, the school's property was deeded to the North Carolina Baptist State Convention. The school attained junior college status in 1926 and changed its name from Buies Creek Academy to Campbell Junior College. In 1961, Campbell became a senior college, and the name was changed to Campbell University on June 6, 1979. [1]

This thoroughfare plan study takes into account the concerns of the Buies Creek area in addressing the patterns of future growth. Thoroughfare plans are created to insure transportation system efficiency development through a cohesive, coordinated system of roads and highways. This report also documents the basic thoroughfare planning principles and procedures used in developing these recommendations. Chapter 1 provides an introduction to the study. Chapters 2 and 3 discusses traffic trends and other issues that affect transportation in the area, as well as the traffic analyses conducted. Finally, detailed descriptions of the study recommendations are provided in Chapter 4.

Further information that will be useful to area planners is provided in the Appendices. The complete Thoroughfare Plan Street Tabulation and typical cross sections, including detailed recommendations, are contained in Appendix A. Appendices B and C address the thoroughfare planning principles and different methods by which the recommendations can be implemented.

---

[1] Harnett County Heritage, 1993.

Chapter 1

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---

[1] Harnett County Heritage, 1993.

Environmental concerns considered in the development of the plan, and an overview of the involvement of the Town and the general public in the development of the plan are shown in Appendices D and E. Recommended definitions and design standards for subdivision ordinances are listed in Appendix F.

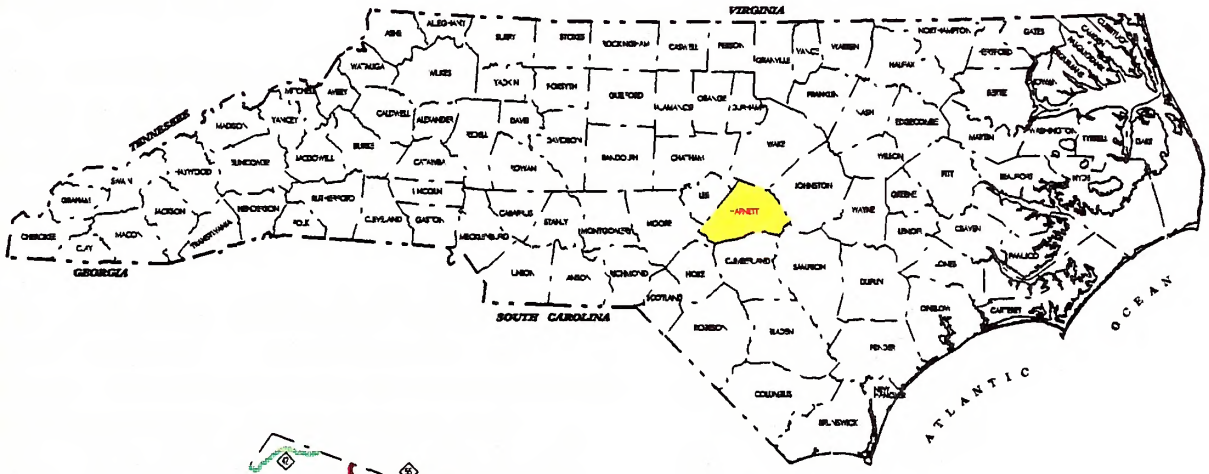
The recommendations are based on general traffic, population, and land use data. Year 2025 average daily traffic projections were used to determine capacity deficiencies. Major and minor thoroughfares were located based on existing and anticipated land uses, field investigation, and topographic conditions. A geographic location of the Buies Creek area is shown in Figure 3 .

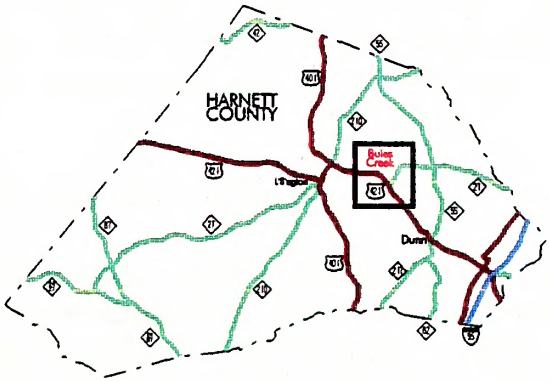
The recommended plan is based on anticipated growth of the area as currently perceived. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific locations and design requirements.

GEOGRAPHIC LOCATION MAP

FOR

BUIES CREEK





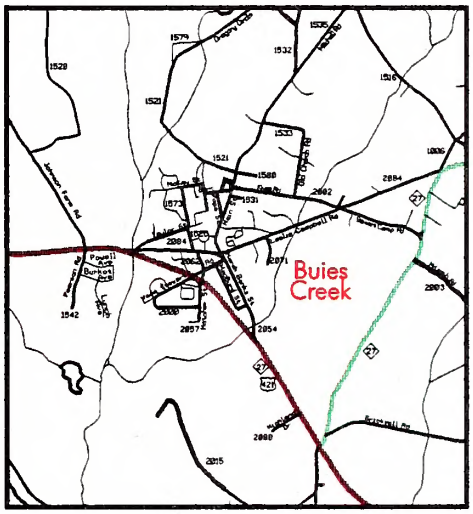


FIGURE 3

Chapter 2

TRENDS AND RELATED ISSUES

Factors Affecting Transportation

The objective of thoroughfare planning is to develop a transportation system which will enable people and goods to travel safely and economically. To find the needs of an area, population, land use, and traffic must be examined.

Population Trends

The traffic volume on any roadway section is closely related to the size and location of the population it serves. A basic step in planning a transportation system is conducting a population study. This study enables the planner to forecast a logical future population and its distribution. A close look at the past will give some indication as to what could occur in the future.

The Buies Creek area has continued to increase its population base over the years, but still remains as a rural community. Population trends and projections for townships in the area are shown as a graph in Figure 4. Population growth is enhanced because of the area's proximity to the Triangle and Fayetteville Urban Areas (which are experiencing major population growth). Table 1 shows the township, the thoroughfare planning boundary, and Harnett County trends.

Economy and Employment

An important factor to consider in estimating the future traffic growth of an area is its economic base. The economic base determines the employment type and size, as well as commuter traffic patterns around the county. This in turn influences the population of an area. The Buies Creek community exists with Campbell University, but is not incorporated. Refer to the Land Use section of this chapter for the businesses located in the planning area.

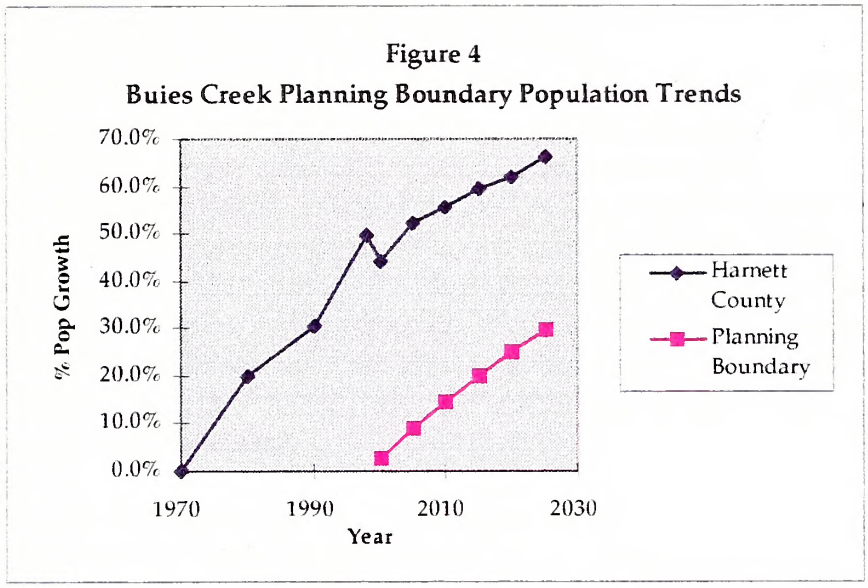


Table 1: Buies Creek Area Population Trends

Year	Harnett County	Neills Creek Township	Grove Township	Planning Boundary
1960	48,236	3,370	4,952	-----
1970	49,667	4,072	4,494	-----
1980	59,570	4,456	5,716	-----
1990	67,833	4,695	7,378	-----
1995	76,839	4,962	7,885	-----
1996	79,488	5,017	7,990	5,314
1997	81,358	-----	-----	5,379
1998	83,411	-----	-----	5,445
2000	86,485	-----	-----	5,579
2005	94,664	-----	-----	5,930
2010	102,301	-----	-----	6,302
2015	110,620	-----	-----	6,697
2020	118,383	-----	-----	7,117
2025	128,162	-----	-----	7,564

Note: Information was obtained from the Office of State Planning and the US Census.

Land Use

Land use refers to physical patterns of activities and functions within an area. Figure 5 shows the planning area's existing land use. Nearly all traffic problems are related to the land use in a specific area. For example, a student union on a college campus might be the cause of congestion during school sessions. However, during the summer (if there is not a summer session), few, if any, problems may occur. The spatial distribution of different land use types (sometimes referred to as traffic generators) predominantly determines when, where, and why congestion occurs. The attraction between different land uses and their association with travel varies depending on the size, type, intensity, and spatial separation of each.

For use in transportation planning, land uses are grouped into four categories:

(1) Residential---all land for housing people (excluding hotels and motels);
(2) Commercial---all land devoted to retail trade including consumer & business services and offices;
(3) Industrial---all land devoted to manufacturing, storage, warehousing, and transportation of products;
(4) Public---all land devoted to social, religious, educational, cultural, recreational, and political activities.

The area includes two banking institutions, two weekly newspapers, and a radio station. It is also served by three churches, two construction companies, six small businesses, a school, post office, and a county government office. The Cape Fear River is the source for much of the area's water needs. The river offers fishing and boating opportunities, and serves as a focal point for the state's 2800-acre Raven Rock Park for picnicking, camping and nature hikes.[2] The Buies Creek area is predominantly a residential community.

Proposed land use for an area is based on its current land use. Determining where expected growth is to occur within the planning area facilitates the location of proposed thoroughfares. Areas of anticipated development and growth for the Buies Creek area are[3]:

---

[2] "Lillington", Map from Lillington Chamber of Commerce, 1995.
[3] Information from Town Agencies and Harnett County, 1996.

LEGEND

- Residential Landuse
- Commercial Landuse
- Industrial Landuse
- University Landuse
- Conservation Landuse
- Planning Area Boundary

June 4, 1998

FIGURE 5

LAND USE

BUIES CREEK

HARNETT COUNTY
NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE

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SCALES

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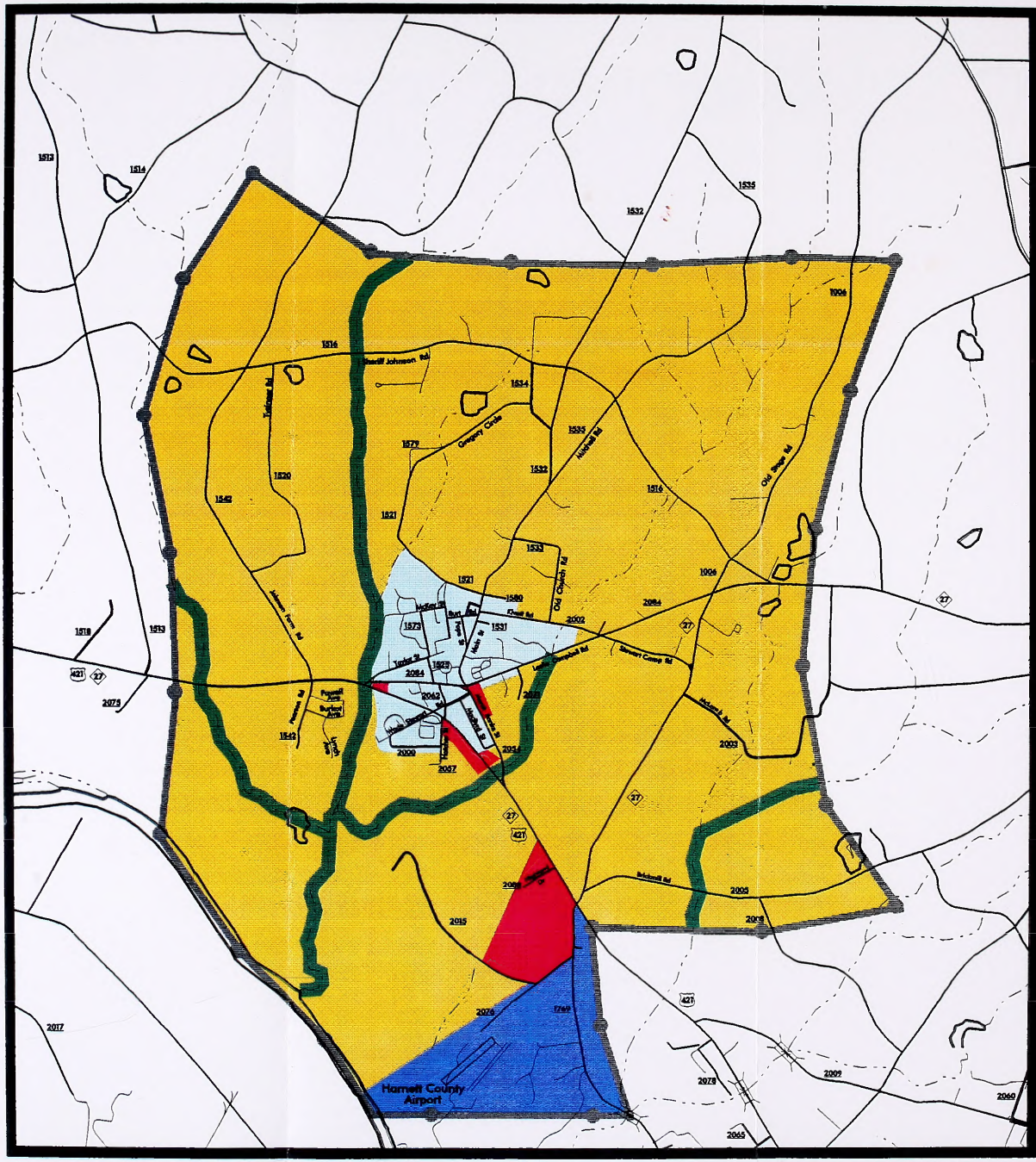

LEGEND

- Residential Landuse
- Commercial Landuse
- Industrial Landuse
- University Landuse
- Conservation Landuse
- Planning Area Boundary

June 4, 1998

FIGURE 5

LAND USE

BUIES CREEK

HARNETT COUNTY
NORTH CAROLINA

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STATEWIDE PLANNING BRANCH

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SCALES

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miles

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kilometers

(1) Residential---all land devoted to housing people excluding hotels and motels. The residential Buies Creek area is anticipated to grow in its southwestern area, due to proposed developments around the Keith Hills Golf Course. A proposed apartment complex will be built just south of the Main Street/Mitchell Road (SR 1532/1535) intersection. The area encompassing the area between Mitchell Road & Old Stage Road (SR 1006) near Sheriff Johnson Road (SR 1516) has been indicated by the Harnett County Planning Department as being the fourth largest growing area in the county.
(2) Commercial---all land devoted to retail trade including consumer & business services and offices. A small amount of commercial development is expected within the planning boundary, and should be located within the campus area.
(3) Industrial---all land devoted to manufacturing, storage, warehousing, and transportation of products. Any industrial development is expected to grow in the south planning area region, near the Harnett County Airport, and along the southeastern section of US 421/NC 27.
(4) Public---all land devoted to social, religious, educational, cultural, recreational, and political activities. Campbell University is proposing the construction of a convocation center for the campus (and for Harnett County's use); however, the location of the proposed center is unknown. The University is considering its location in the northeast quadrant of the Main Street/Marshbanks Road/Leslie Campbell Road intersection.

The western and northern portions of the planning area have the largest growth expectations.

Chapter 3

TRAVEL DEFICIENCY ANALYSIS OF EXISTING SYSTEM

This chapter presents an analysis of the existing street system. Emphasis is placed on detecting the deficiencies and understanding their cause. Travel deficiencies may be inadequate pavement width or intersection controls. Systemand capacity deficiencies could occur, such as a need for a bypass, loop facility, construction of missing links, or additional radials.

Travel Demand

Existing major street systems satisfy the travel demand when characteristics of each thoroughfare (i.e., number of lanes) allow traffic to move efficiently. Travel is generally reported as Annual Average Daily Traffic (AADT). Traffic counts are taken regularly on State-maintained roads by the NCDOT.

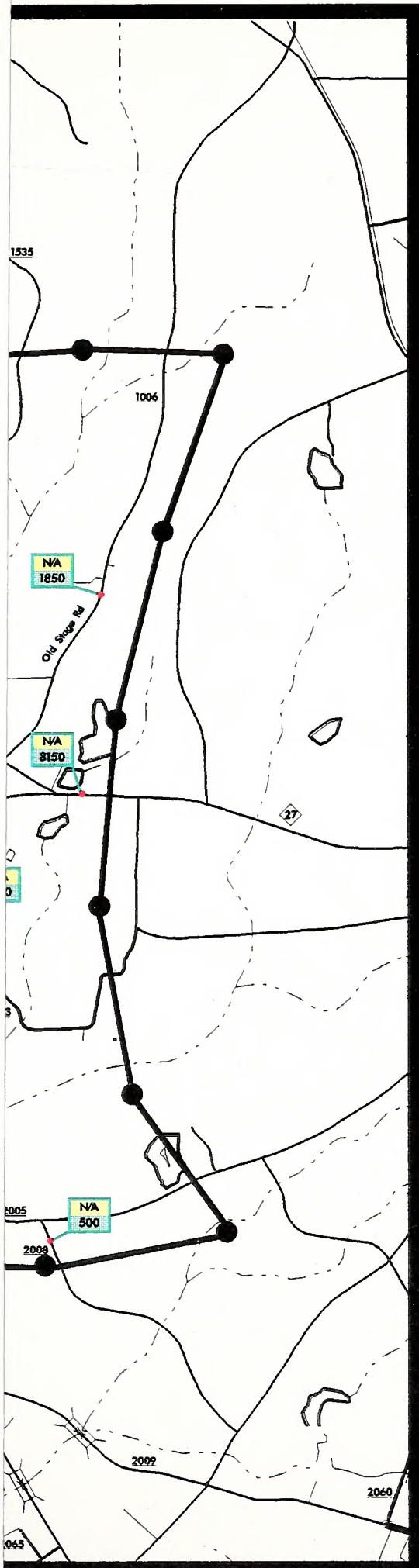
The source of traffic in the Buies Creek area is twofold. Local traffic is generated by the residents of the area and the University. The remainder is from people traveling through the area.

A comparison of annual traffic growth rates from 1985 to 1995 at various count locations in the planning area shows average growth rates ranging from 1.0% to 4.2%. The largest growth rates occurred on Gregory Circle (SR 1521) and along Main Street (SR 1532) from Leslie Campbell Road (SR 2084) to 0.1 mi north of Leslie Campbell Road. These large growth rates are due to the growth of the Campbell University and the increase in the number of dwellings occurring along Gregory Circle. Figure 6 shows the Average Daily Traffic from the design year (1995) to the future year (2025).

Traffic Accidents

A traffic accident analysis is also done as part of a thoroughfare plan study. The source of traffic accidents can be analyzed into three general categories: (1) the physical environment, (2) the driver, and (3) the physical attributes of the vehicle itself. The physical environment includes such things as road condition and obstructions, weather, and traffic conditions. The driver influences the occurrence of traffic accidents through his mental alertness, distractions in the car, and reaction time. The physical attributes of the vehicle include the condition of the brakes and tires, vehicle responsiveness, and size of the vehicle. All traffic accidents can be attributed to one or more of these sources; however, the driver is often the primary source.

Accident data for January, 1992 through September, 1996 was analyzed as part of this study. Table 2 shows the type of accidents that occurred within the planning boundary and their locations. Table 3 shows the intersections with 5 or more accidents located at them. Figure 7 shows the locations of the intersections with 5 or more accidents.



LEGEND

1995 Average Daily Traffic 0000
2025 Average Daily Traffic 0000

Planning Area Boundary

June 4, 1998

FIGURE 6

AVERAGE DAILY TRAFFIC COUNTS

BUIES CREEK

HARNETT COUNTY
NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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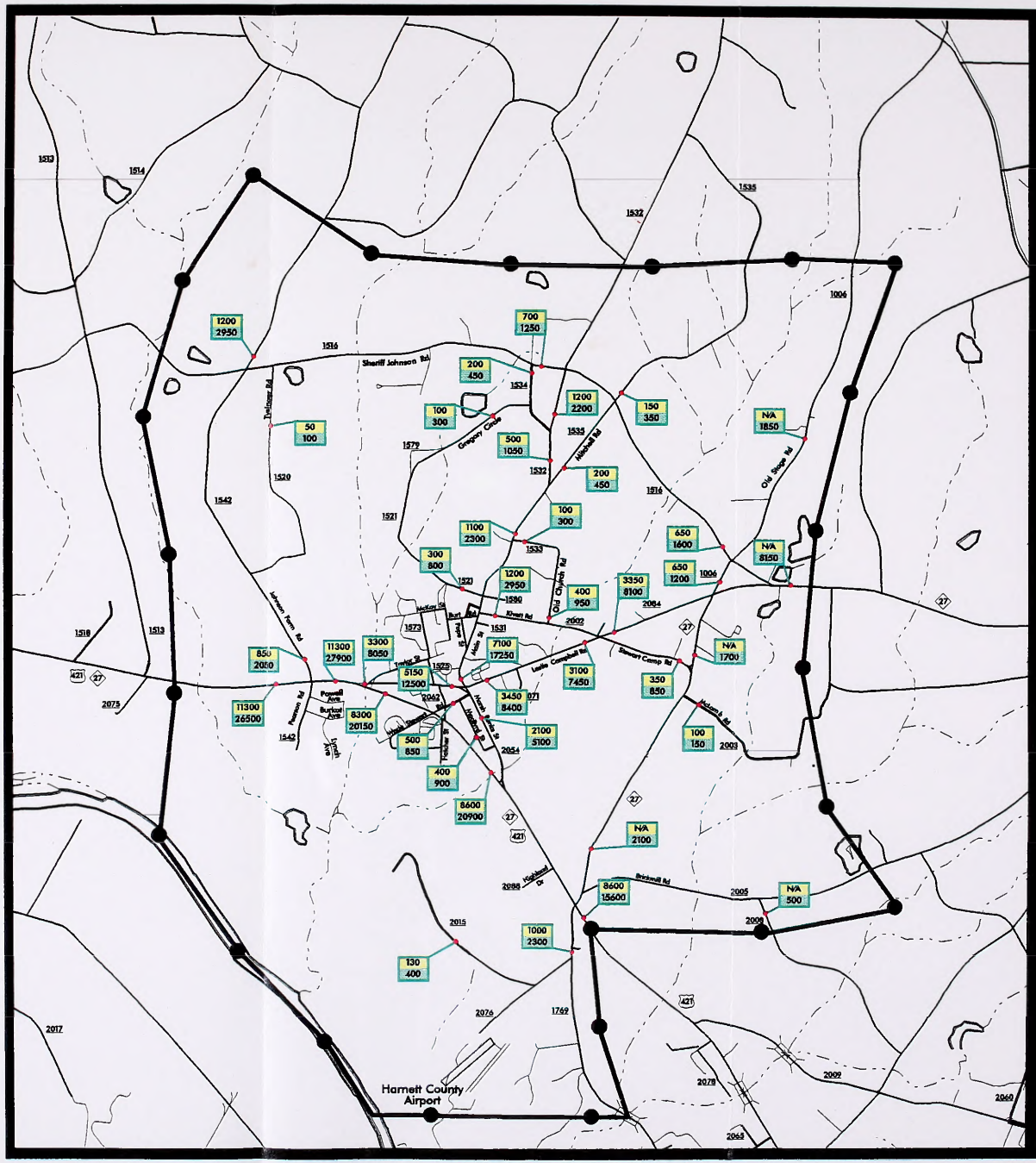

LEGEND

1995 Average Daily Traffic 0000
2025 Average Daily Traffic 0000

Planning Area Boundary

June 4, 1998

FIGURE 6

AVERAGE DAILY TRAFFIC COUNTS

BUIES CREEK

HARNETT COUNTY
NORTH CAROLINA

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SCALES

0 1 1.25 1.5
miles

0 1 2
kilometers

Table 2
Type of Accidents and Their Locations (Between 1/1/92 and 10/31/97)

Ran-off-road: 13 US 421/Old Buies Creek Rd/Pearson Rd Sheriff Johnson Rd /Main St (2) NC 27/Old Stage Road Pope Street/Main Street NC 27/Sheriff Johnson Rd Pope Street/Burt Street NC 27/McLamb Road Main St/Leslie Campbell Rd (2) Old Stage Road/ Sheriff Johnson Road (3)	**Other: 9 (Backup (4), Parked Vehicle, Head-On, Overturn, Animal (2))** US 421/NC 27 Judge Taylor Street/Davis Street US 421/Hatcher Street/Harmon Road Main Street/Burt Street NC 27/McLamb Road MacByrd St/Marshbanks Rd Old Stage Road/Leslie Campbell Road Judge Taylor St/ T.T. Lanier St Main St/Stewart Camp Rd/Kivett Rd
Left-turn-same-road: 7 US 421/Leslie Campbell Road (3) Pope Street/Main Street (3) NC 27/McLamb Road	**Right-turn-different-road : 2** NC 27/Old Stage Road (North Leg) T.T. Lanier St/Leslie Campbell Rd
Angle: 50 US 421/NC 27 East Stewart Camp Rd/Kivett Rd/Leslie Campbell Rd US 421/Johnson Farm Rd/Pearson Rd US 421/NC 27/Old Stage Road (South Leg) Main St/Marshbanks Rd/Leslie Campbell Rd (23) NC 27/Old Stage Road (North Leg) (2) US 421/Wade Stewart Circle Sheriff Johnson Rd/Johnson Farm Rd/Pearson Rd(4) US 421/Hatcher St/Harmon Rd (7) Old Stage Rd (North Leg)/Sheriff Johnson Rd (3) Marshbanks Rd/Pine Cone Rd Sheriff Johnson Rd/Main St (5)	**Rear-End: 18** US 421/Johnson Farm Rd/Pearson Rd Old Church Rd/Stewart Camp Rd/Kivett Rd Main St/Stewart Camp Rd/Kivett Rd US 421/Marshbanks Road US 421/Leslie Campbell Road (7) Harmon Road/Leslie Campbell Road T.T. Lanier St/Leslie Campbell Rd Main St/Marshbanks Rd/Leslie Campbell Rd (23) Pope Street/Main Street (2) Judge Taylor St/T.T. Lanier St Upchurch Lane/Main Street
Left-turn-different-road: 18 US 421/NC 27/Old Stage Rd (South Leg) Pope Street/Burt Street (3) US 421/Wade Stewart Circle Judge Taylor Street/Davis Street US 421/Marshbanks Road T.T. Lanier St/Leslie Campbell Rd NC 27/McLamb Road (2) Sheriff Johnson Rd/Tysinger Rd Old Stage Road (South Leg)/Airport Road Sheriff Johnson Rd/Johnson Farm Rd Main St/Marshbanks Rd/Leslie Campbell Rd (2) US 421/Johnson Farm Road/Pearson Road (3)	**Sideswipe: 1** Old Stage Road/Sheriff Johnson Road
Total = 97	

Table 3
Intersections with 5 or more Accidents

Location	Number of Accidents	Number of Injuries	Severity Code			
			F	A	B	C
Main Street/Marshbanks Road/Leslie Campbell Road	28	24	0	1	6	17
US 421/Hatcher Street/ Harmon Road	9	9	0	1	5	3
Pope Street/Main Street	8	3	0	0	0	3
US 421/Leslie Campbell Rd	8	3	0	1	0	2
Old Stage Road (North Leg)/ Sheriff Johnson Road	7	10	0	2	3	5

F: Fatality
A: Class "A" Injury (Incapacitating). The injury is obvious and severe enough to prevent carrying on normal activities for at least 24 hours; e.g., massive loss of blood or broken bone.
B: Class "B" Injury (Non-incapacitating). In this case, and injury other than a fatality or Class "A" injury is evident.
C: Class "C" Injury. No visible sign of injury, but complaint of pain or momentary loss of consciousness occurs.

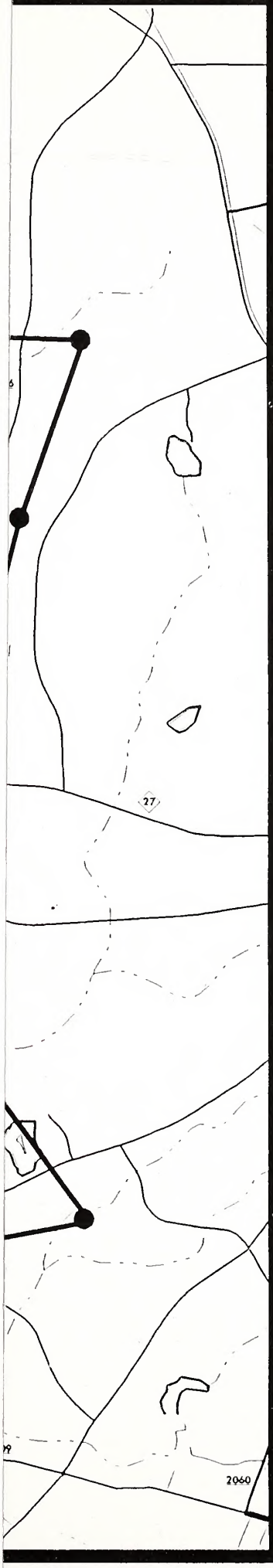
Capacity Analysis

Capacity deficiencies are found by comparing the traffic volumes with the traffic mobility of the streets. The ability of traffic to move on a street freely, safely, and efficiently with a minimum delay is controlled principally by the spacing of signs, the number of traffic signals used, or parking.

A capacity analysis will determine the *level of service* being provided. Six levels of service identify the range of possible conditions. (See Table 4 and Figure 8 for more of an explanation.) The definitions are general & conceptual in nature, but may be applied to urban arterial levels of service. The 1994 Highway Capacity Manual contains more detailed descriptions of the levels of service as defined for each facility type.

The recommended improvements of the Thoroughfare Plan were based on achieving a minimum of LOS D on existing and new facilities. LOS D is considered the "practical capacity" of a facility, or that at which the public begins to express dissatisfaction.

The primary routes serving Buies Creek are US 421 and NC 27. The town is also served by Old Stage Road (SR 1006), Main Street (SR 1532), Johnson Farm Road/ Pearson Street (SR 1542), and Leslie Campbell Road (SR 2084). The majority of the streets within the planning boundary run in a radial pattern. All thoroughfares in the planning boundary are two-lane facilities, with the exception of US 421/NC 27. The majority of the capacity problems occurring in the Buies Creek area during the planning period occur near the Campbell University campus. The most notable congested areas during the design year 2025 are along Main Street (SR 1532) and Leslie Campbell Road (SR 2084) adjacent to the campus. The congestion occurs mainly during school sessions (August through May).



LEGEND

Number of Accidents 00

Planning Area Boundary

NOTE:
Map only indicates locations with 5 or more accidents over a 4.8 year period (1/92 – 10/97).

June 4, 1998

FIGURE 7

ACCIDENT LOCATIONS

BUIES CREEK

HARNETT COUNTY
NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 1 1.25 1.5
miles

0 1 2
kilometers

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Old Stage Road (North Leg)/ Sheriff Johnson Road	7	10	0	2	3	5

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June 4, 1998

FIGURE 7

ACCIDENT LOCATIONS

BUIES CREEK

HARNETT COUNTY
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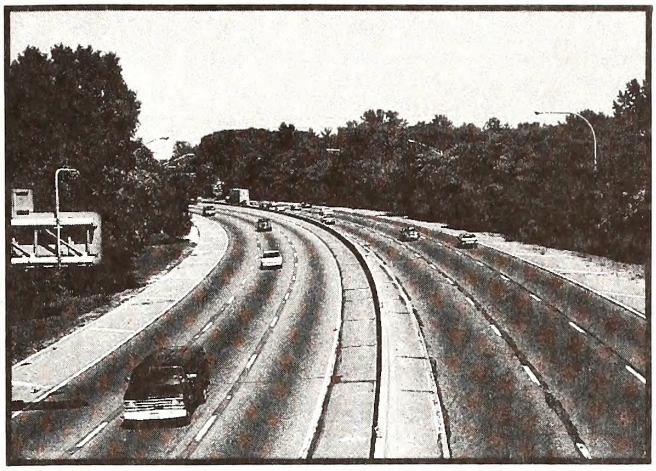
SCALES

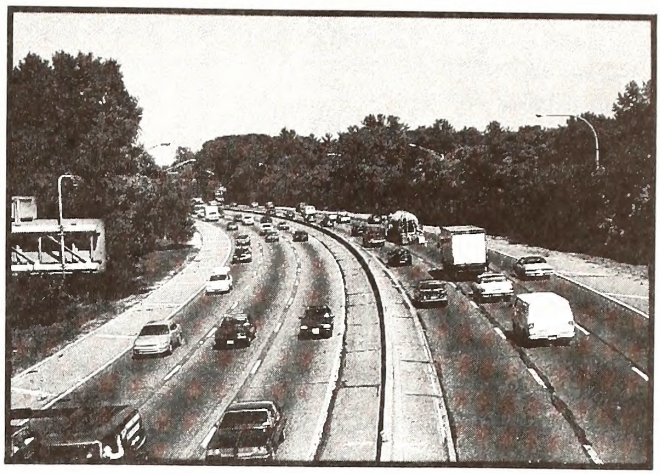
0 1 1.25 1.5
miles

0 1 2
kilometers

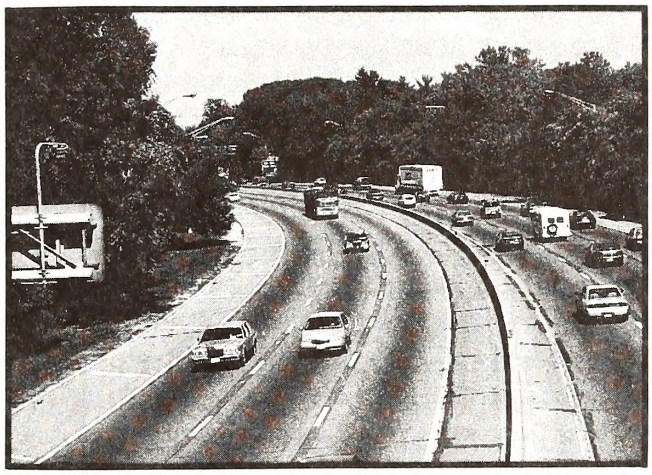
Source: 1994 Highway Capacity Manual



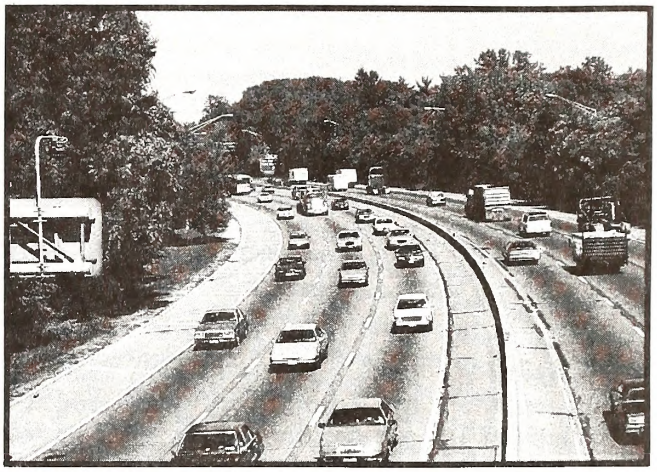
LOS A.



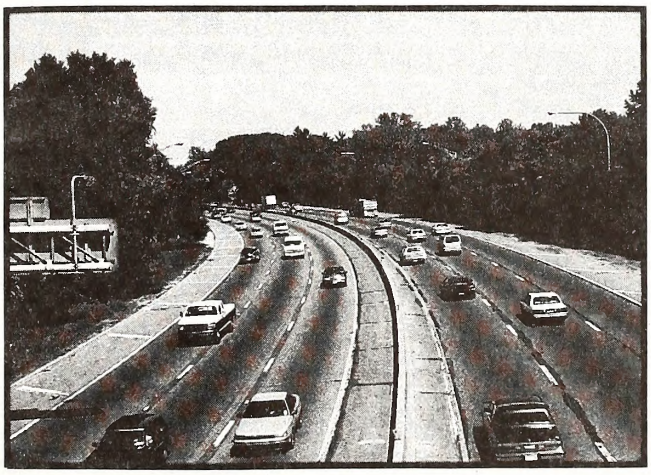
LOS D.



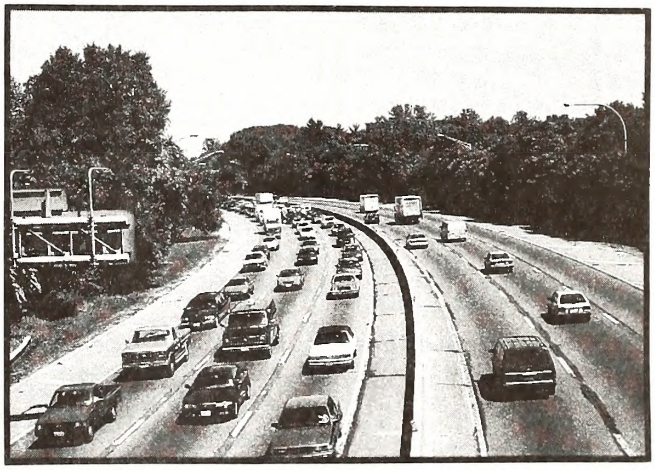
LOS B.



LOS E.



LOS C.



LOS F.

FIGURE 8

LEVELS OF SERVICE

Table 4: Level of Service

LOS A	Describes primarily free flow conditions. The motorist experiences a high level of physical and psychological comfort. The effects of minor incidents of breakdown are easily absorbed. Even at the maximum density, the average spacing between vehicles is about 528 ft, or 26 car lengths.
LOS B	Represents reasonably free flow conditions. The ability to maneuver within the traffic stream is only slightly restricted. The lowest average spacing between vehicles is about 330 ft, or 18 car lengths.
LOS C	Provides for stable operations, but flows approach the range in which small increases will cause substantial deterioration in service. Freedom to maneuver is noticeably restricted. Minor incidents may still be absorbed, but the local decline in service will be great. Queues may be expected to form behind any significant blockage. Minimum average spacings are in the range of 220 ft, or 11 car lengths.
LOS D	Borders on unstable flow. Density begins to deteriorate somewhat more quickly with increasing flow. Small increases in flow can cause substantial deterioration in service. Freedom to maneuver is severely limited, and the driver experiences drastically reduced comfort levels. Minor incidents can be expected to create substantial queuing. At the limit, vehicles are spaced at about 165 ft, or nine car lengths.
LOS E	Operations in this level are volatile with little or no usable gaps in the traffic stream. Any disruption to the traffic stream can cause a wave of delay that propagates throughout the upstream traffic flow. This can produce a serious breakdown with extensive queuing. Maneuverability within the traffic stream is extremely limited, and driver tensions are high. The high delay values created by LOS F at signalized intersections indicate poor progression, long cycle lengths, and high v/c ratios (ratio of the demand flow rate to capacity for a traffic facility).
LOS F	Describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points.

Chapter 4

RECOMMENDATIONS

This chapter presents the thoroughfare plan recommendations. It is the goal of this study to recommend a plan for the transportation system that will serve the anticipated traffic and land development needs of the Buies Creek planning area over the next 30 years. The primary objective of this plan is to reduce traffic congestion and improve safety by eliminating both existing and anticipated deficiencies. These recommendations are shown in Figure 1. The recommended thoroughfare plan is shown in Figure 2 .

Major Thoroughfares
Existing major thoroughfares include the following:

US 421 is a four-lane facility between the western planning boundary and the US 421/Old Stage Road intersection. Current traffic volumes range from 8,600 to 11,500 vehicles per day (vpd). The traffic is projected to increase to a range of 15,600 to 27,950 vpd. The existing cross section will support the current and future traffic; therefore, no further improvements are recommended for US 421.

NC 27 is concurrent with US 421 as a 4-lane divided facility from the west end of the planning boundary to the US 421/Old Stage Road intersection. At that point, NC 27 turns north towards Leslie Campbell Road as a two-lane facility. NC 27 then turns east to continue to the east planning boundary limits. Traffic volumes in 1990 were 650 vpd, and are projected to range from 1,750 to 8,150 vpd. The existing cross section will support the current and future traffic. Improvements recommended for NC 27 are to widen the road to 7 m along the section straddling between Old Stage Road/Leslie Campbell Road and the planning boundary for safety reasons.

Old Stage Road (SR 1006) extends north from the NC 27/Leslie Campbell Road intersection out of the planning boundary. The road serves residents, farm properties and businesses in the area. Current traffic volumes are 650 vpd, and are projected to 1,200 vpd. The existing cross section will support current and future traffic and should not experience vehicular capacity problems.

Sheriff Johnson Road (SR 1516) is a two-lane facility extending from the western planning boundary to intersect with NC 27. The road serves residential and farm properties. Current traffic volumes range from 650-700 vpd, and are projected to range from 1,250 to 1,600 vpd. The existing cross section will support the current and future traffic. Safety improvements recommended for Sheriff Johnson Road are to widen the road to 7 m.

Main Street/Oak Grove Road (SR 1532) begins at Leslie Campbell Road and extends north through Campbell University to continue out of the planning boundary. The road serves residential & farm properties and various businesses in the area. Main Street/Oak Grove Road has current traffic volumes ranging from 500-7,100 vpd. The existing cross section will support these and future projected volumes of the section north of Old Church Road (1,050-2,300 vpd). However, the section from Leslie Campbell Road to 0.2 km north of Old Church Road will not support the future projected traffic of 17,250 vpd. This section of Main Street should be widened for allowance of a center lane to aid any turning traffic. (Refer to the proposed minor thoroughfare section for more information to relieving further congestion on this section of Main Street.) For safety reasons, the remaining sections should be widened to 7 m.

Johnson Farm Road/Pearson Road (SR 1542) begins south of US 421/NC 27 at the gate of a country club. Johnson Farm Road extends north to cross US 421/NC 27 and Sheriff Johnson Road to continue out of the planning boundary. Current traffic volumes range from 850-1,200 vpd, and are projected to range from 2,050-2,950 vpd. The existing cross section will support the current and future traffic. Safety improvements recommended for Johnson Farm Road/Pearson Road from US 421/NC 27 north to the planning boundary are to widen the road to 7 m.

Leslie Campbell Road (SR 2084) is the western access point for Campbell University from US 421/NC 27 and continues east to intersect NC 27 East. The route also serves farm lands and small businesses. Leslie Campbell Road has current traffic volumes ranging from 3,100-5,150 vpd. The existing cross section will support these volumes, as well as future projected volumes of the section east of Main Street (7,450-8,400 vpd). However, the section from Judge Taylor Street to Main Street will become more congested with the future projected traffic of 12,500 vpd approaching capacity. Spot Safety Funds (refer to Appendix C for further information) have been requested, as of June 12, 1998, for a two-phase traffic signal installation at the Main Street/Marshbanks Road/Leslie Campbell Road intersection. Widening for an exclusive right turn from Main Street to Leslie Campbell Road shall also be constructed under the Spot Safety Project. The proposed route from Mitchell Road to Leslie Campbell Road and widening of Main Street and Leslie Campbell Road will help to alleviate the congestion along these routes.

There are no proposed major thoroughfares in this area.

Minor Thoroughfares
Existing minor thoroughfares include:

Gregory Circle (SR 1521) begins its semicircular route at Main Street and ends at Boykin Road. This two-lane facility has undergone recent construction for drainage purposes crossing under the road while serving residences and small businesses. Current traffic volumes range from 150-350 vpd, and are projected to range from 300-750 vpd. The existing cross section will support the current and future traffic.

Old Church Road (SR 1533) is a two-lane facility that extends east from Main Street, takes a sharp turn to the south, and ends at Kivett Road. The road serves residential & farm properties. Current traffic volumes range from 80-400 vpd, and are projected to range from 300-950 vpd. The existing cross section will support the current and future traffic.

Mitchell Road (SR 1535) is a route that extends north from Main Street, crosses Sheriff Johnson Road, and continues out of the planning area. The two-lane facility serves residential & farm properties and small businesses. Current traffic volumes range from 90-170 vpd, and are projected to range from 350-450 vpd. The existing cross section will support the current and future traffic.

Old Stage Road (SR 1769) extends south from US 421/NC 27 as a 2-lane facility that continues out of the planning boundary. The road serves residential & farm properties and businesses (including the Harnett County Airport). This section of Old Stage Road should be widened to 7 m from 0.3 km south of US 421/NC 27 to a bridge crossing Thornton Creek for safety reasons.

Stewart Camp Road/Kivett Road (SR 2002) extends east from Main Street, intersects Leslie Campbell Road, and ends at NC 27. The two-lane facility serves residential & farm properties and small businesses. Current traffic volumes range from 350-1,200 vpd, and are projected to range from 850-2,950 vpd. The existing cross section will support the current and future traffic. Safety improvements recommended for Stewart Camp Road/Kivett Road are to widen the road to 7m for safety reasons.

Marshbanks St (SR 2054) is a 2-lane facility extending south from the Main St/Leslie Campbell Rd intersection and ending at US 421/NC 27. The route serves residences. The current traffic volume is 2,100 vpd, projected to a future volume of 5,100 vpd. The existing cross section will support both volumes.

A majority of the local access streets within the town are state-owned secondary roads with widths between 16' and 20'. Even though the average daily traffic on these roads is less than 500, it is recommended that these state-owned roads with a width below 18' be widened to that width by NC DOT. Each of these thoroughfares are two-lane collectors. No capacity problems exist on these facilities during the planning period. Refer to Appendix A for specific improvements needed on these routes.

Proposed Minor Thoroughfares include:

The proposed minor thoroughfare for the planning area is a route beginning 0.2 km south of the Main Street/Mitchell Road (SR 1532/1535) intersection, continuing south to cross Old Church Road (SR 1533) twice (detaching the sharp curve from the main road in order to miss a house), traversing along the southbound leg of Old Church Road, and ending at an intersection with Leslie Campbell Road (SR 2084). This new-location bypass will help alleviate the capacity deficiency of Main Street by rerouting any traffic coming from the north or west of the planning boundary that are bound for the eastern campus side.

Appendix A

Typical Cross Sections, Thoroughfare Plan Street Tabulation, and Recommendations

Typical Cross Sections

Cross section requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired LOS, and available right-of-way (ROW).

Typical cross sections recommended by the Statewide Planning Branch are shown in Figure 9. These cross sections are typical for facilities at new locations and where ROW constraints are not critical. For widening or urban projects with limited ROW, special cross sections should be developed to meet the needs of the project.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available ROW.

On all existing and proposed major thoroughfares delineated on the thoroughfare plan, adequate ROW should be protected or acquired for the ultimate cross sections. Ultimate desirable cross sections for each of the thoroughfares are listed here. Recommendations for "ultimate" cross sections are provided for:

1) thoroughfares requiring widening after the current planning period;
2) thoroughfares which are borderline adequate, where accelerated traffic growth could render them deficient; and
3) thoroughfares where an urban curb-and-gutter cross section may be locally desirable because of urban expansion or redevelopment.

Recommended design standards relating to maximum and minimum grades, minimum sight distances, maximum degree of curve and related superelevation, and other considerations for thoroughfares are given in Appendix D.

A - Four Lanes Divided with Median, Freeway
This cross section is typical for four-lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 14 m (46 feet), but a wider median is desirable.

B - Seven Lanes, Curb & Gutter
This cross section is not recommended for new projects. When the conditions warrant six lanes, cross section "D" should be recommended. Cross section "B" should be used only in special situations such as widening from a five lane section when ROW is limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section "D" is the final cross section.

C - Five Lanes, Curb & Gutter
Typical for major thoroughfares, this cross section is desirable where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

D - Six Lanes Divided with Raised Median, Curb & Gutter
E - Four Lanes Divided with Raised Median, Curb & Gutter
These cross sections are typically used on major thoroughfares where left turns and intersection streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.8 m (16 ft) median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

F - Four Lanes Divided, Boulevard, Grass Median
Recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24 ft) is recommended with 9.1 m (30 ft) being desirable.

G - Four Lanes, Curb & Gutter
This cross section is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and ROW is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If ROW is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

H - Three Lanes, Curb & Gutter
In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require this cross section.

I - Two Lanes, Curb & Gutter with Parking on Both Sides
J - Two Lanes, Curb & Gutter with Parking on One Side
Cross sections "I" and "J" are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "I" would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

K - Two Lanes, Paved Shoulder
This cross section is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full ROW of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m. In those cases, 21 m (70 ft) should be preserved with the understanding that the full 30 m will be reserved by use of building setbacks and future street line ordinances.

L - Six Lanes Divided with Grass Median, Freeway
Cross section "L" is typical for controlled access freeways. The 14 m (46 ft) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending upon cut and fill requirements.

M - Eight Lanes Divided with Raised Median, Curb & Gutter
Also used for controlled access freeways, this cross section may be recommended for freeways going through major urban areas or for routes projected to carry very high volumes of traffic.

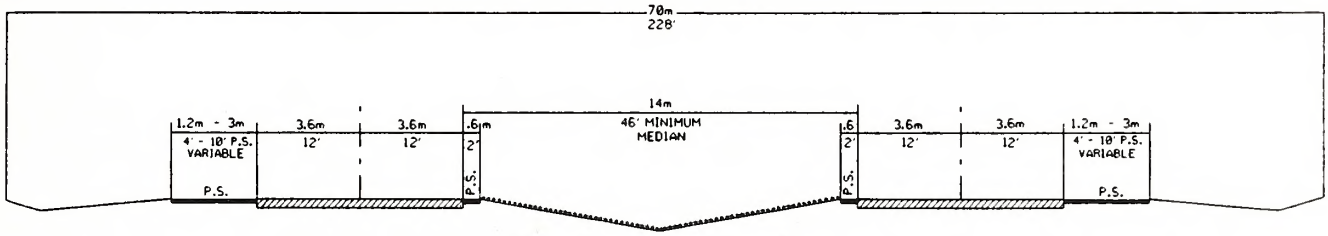
N - Five Lanes, Curb & Gutter, Widened Curb Lanes
O - Two Lanes, Shoulder Section
P - Four Lanes Divided with Raised Median, Curb & Gutter, Widened Curb Lanes
If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities.

Other General Information
The urban curb & gutter cross sections illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum ROW line. This permits adequate setback for utility poles. If the sidewalk is moved farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The rights-of-way shown for the typical cross sections are the minimum required to contain the street, sidewalks, utilities, and drainage facilities. Additional cut and fill may require additional ROW or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

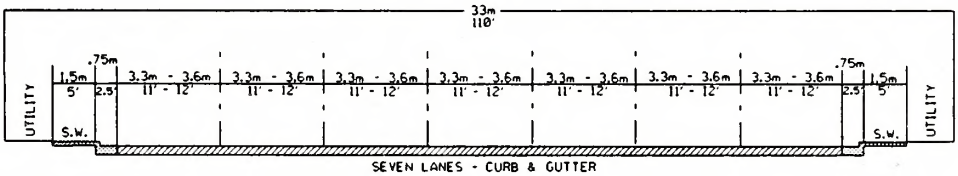
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



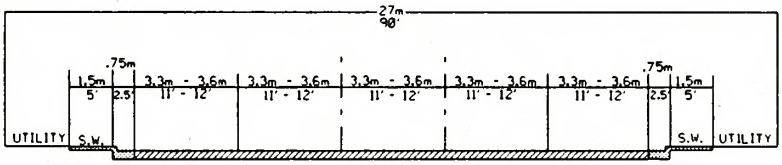
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



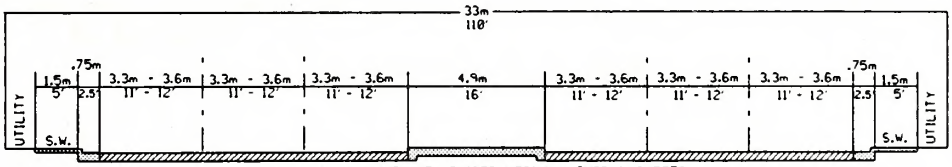
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

D.

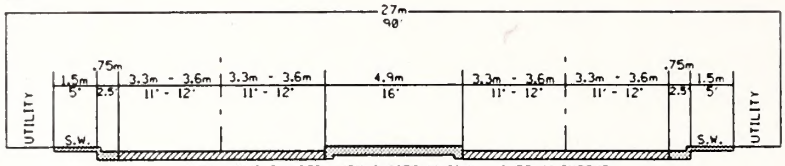


SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

FIGURE 9

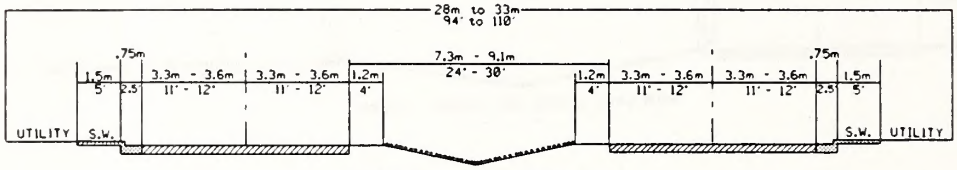
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



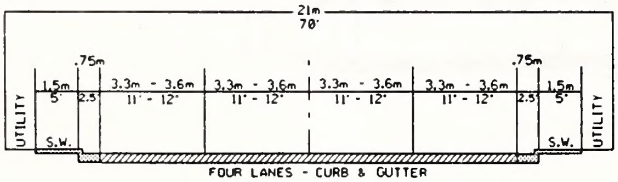
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



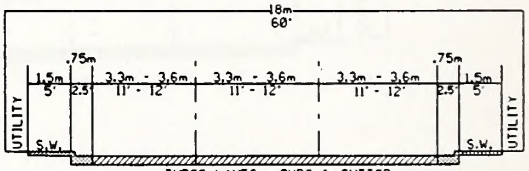
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



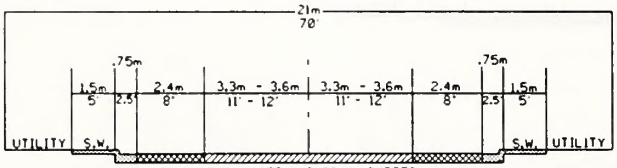
FOUR LANES - CURB & GUTTER

H.



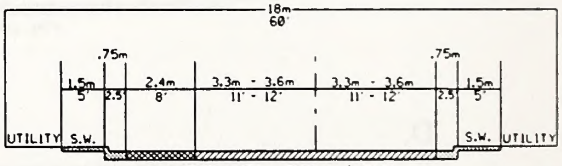
THREE LANES - CURB & GUTTER

I.



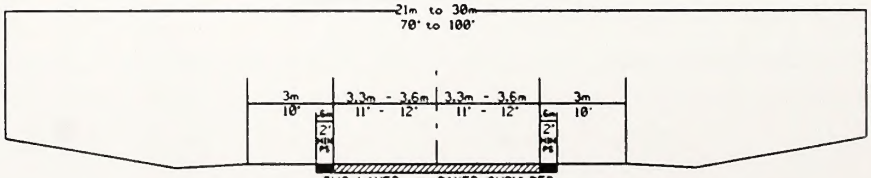
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

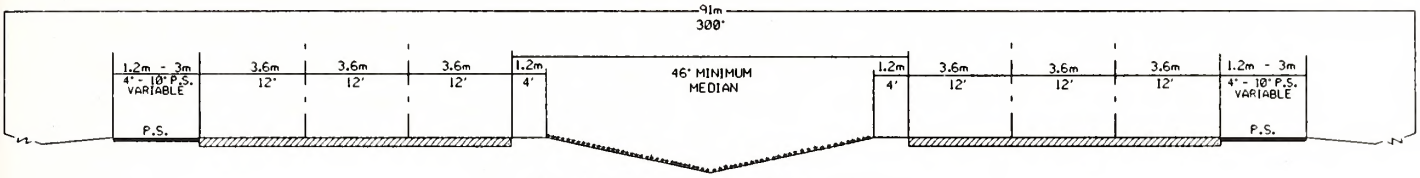
K.



TWO LANES - PAVED SHOULDER

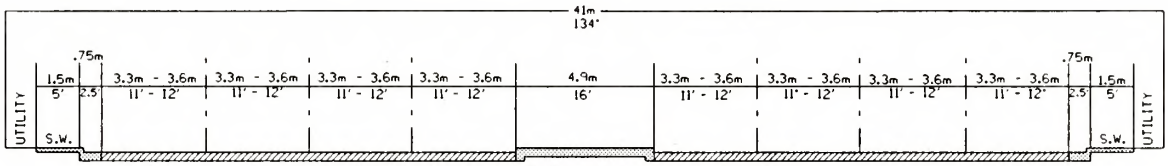
TYPICAL THOROUGHFARE CROSS SECTIONS

L.



SIX LANES DIVIDED WITH GRASS MEDIAN - FREEWAY

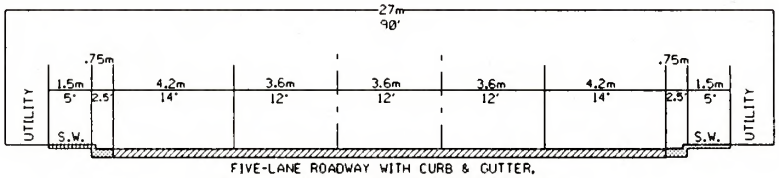
M.



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

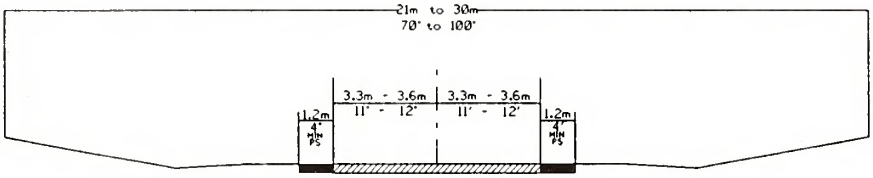
TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

N.



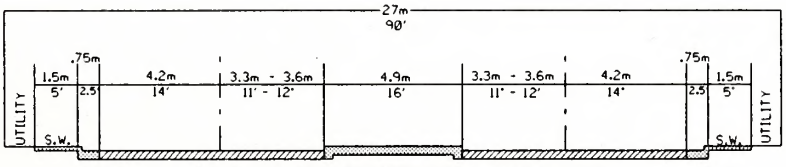
FIVE-LANE ROADWAY WITH CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

O.



TWO LANES - SHOULDER SECTION

P.



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

Thoroughfare Plan Street Tabulation and Recommendations

Table 5 shows a detailed tabulation of all roads identified as elements of the Buies Creek Area Thoroughfare Plan. It also includes a description of each road section, as well as the length, cross-section, and right-of-way for each section. Also included are existing and projected average summer weekday traffic volumes, roadway capacity, and the recommended ultimate lane configuration.

The following index of abbreviations may be helpful in interpreting Table 5:

- ADQ - Adequate
- AADT - Annual Average Daily Traffic
- int., ints. - intersection
- km - kilometers
- km/h - kilometers per hour
- LL - Lillington
- m - meters
- mi - miles
- N--, S--, E--, W-- - North, South, East, West
- N/A - Not Available
- P. Bndy. - Planning Boundary
- ROW - Right of Way Width
- SR - Secondary Road
- TIP Projs - TIP Projects (refer to Appendix C for TIP information)
- UNK - Unknown
- vpd - Vehicles per Day

Table 5
Buies Creek Area Thoroughfare Plan Chart

Facility and Section		Existing Cross Section (1996)						Future Cross Section (2025)			2025 Recommended Cross Section	
		Distance	Roadway		ROW	Capacity	ADT	Capacity	ADT	ADT w/TIP Projs		
from	to	(km)	(m)	Lanes	(m)	(vpd)	(vpd)	(vpd)	(vpd)	(vpd)	Cross Section	ROW (m)
US 421												
Western Planning Boundary	Leslie Campbell Road (72.4 km/h)	1.74	20	4	46	40000	12800	40000	27000	27000	ADQ	ADQ
Leslie Campbell Road	Concrete median	0.56	20	4	46	41000	8500	41000	20150	20150	ADQ	ADQ
Concrete median	Marshbanks Road	0.96	20	4	46	41000	8500	41000	20400	20400	ADQ	ADQ
Marshbanks Road	Highland Drive	0.88	20	4	46	41000	9000	41000	20900	20900	ADQ	ADQ
Highland Drive	NC 27	0.32	20	4	46	41000	9000	41000	20900	20900	ADQ	ADQ
NC 27	0.48 km E of NC 27 (P.Bndy)	0.48	20	4	46	41000	-----	41000	15600	15600	ADQ	ADQ
NC 27												
US 421 (becomes East NC 27)	0.24 km N of US 421	0.24	11	2	31	15000	-----	15000	2100	2100	ADQ	ADQ
0.24 km N of US 421	Old Stage Rd (North Leg)/Leslie Campbell Rd	2.90	7	2	31	13000	950	13000	1700	1700	ADQ	ADQ
Old Stage Rd (N Leg)/Leslie Campbell Rd	0.32 km E of SR 1516 (Planning Boundary)	0.88	6	2	31	11000	3400	13000	8150	8150	K	ADQ
Old Stage Road (North Leg) (SR 1006)												
NC 27/Leslie Campbell Road	Culvert	3.14	7	2	N/A	13000	-----	13000	1200	1200	ADQ	60
Culvert	Planning Boundary	0.64	7	2	N/A	13000	-----	13000	1500	1500	ADQ	60
Sheriff Johnson Road (SR 1516)												
NC 27	Main Street/Oak Grove Road	2.66	6	2	N/A	11000	-----	13000	1600	1600	K	60
Main Street/Oak Grove Road	Johnson Farm Road	2.98	6	2	N/A	11000	-----	13000	1250	1250	K	60
Johnson Farm Road	0.97 km W of Johnson Farm Road (at a Bridge)	0.97	7	2	N/A	12000	-----	13000	1250	1250	K	60
Main Street/Oak Grove Road (SR 1532)												
Leslie Campbell Road	Leslie Campbell Road	0.16	6	2	N/A	11000	-----	20500	17250	12000	H	60
Leslie Campbell Road	Upchurch Lane	0.40	8	2	N/A	13500	-----	20500	17250	12000	ADQ/H	60
Upchurch Lane	Old Church Road (56 km/h)	0.88	6	2	N/A	11000	-----	20500	17250	12000	H	60
Old Church Road (88.5 km/h)	Mitchell Road	0.56	6	2	N/A	11000	-----	13000	2300	2300	K	60
Mitchell Road	Sheriff Johnson Rd (Northern Planning Bndy)	1.53	6	2	N/A	11000	-----	13000	1050	1050	K	60
Old Church Road (SR 1533)												
Main Street	0.32 km E of Main Street	0.32	6	2	18	11000	400	13000	950	950	K	ADQ
0.32 km E of Main Street	Kivett Road	0.72	6	2	18	11000	100	13000	300	300	K	ADQ
Mitchell Road (SR 1535)												
Main Street	Sheriff Johnson Road	0.97	7	2	18	13000	200	13000	450	450	ADQ	ADQ
Sheriff Johnson Road	Northern Planning Boundary	1.77	7	2	18	13000	100	13000	350	350	ADQ	ADQ
Johnson Farm Road/Pearson Road (SR 1542)												
Northern Planning Boundary	Sheriff Johnson Road	1.45	6	2	18	11000	-----	13000	2950	2950	K	ADQ
Sheriff Johnson Road	US 421/NC 27	3.14	6	2	18	11000	-----	13000	2050	2050	K	ADQ
Old Stage Road (South Leg) (SR 1769)												
US 421/NC 27	US 421	0.32	7	2	18	12000	-----	12000	2200	2200	ADQ	ADQ
US 421	Airport Road	1.05	6	2	18	9000	-----	13000	2200	2200	K	ADQ
Airport Road	Southern Planning Boundary	0.72	6	2	18	9000	-----	13000	N/A	N/A	K	ADQ
Stewart Camp Road/Kivett Road (SR 2002)												
NC 27	Leslie Campbell Road	0.97	6	2	18	9000	-----	13000	850	850	K	ADQ
Leslie Campbell Road	Main Street (56 km/h)	1.05	6	2	18	11000	-----	13000	2950	2950	K	ADQ
Marshbanks Street (SR 2054) (56 km/h)												
US 421/NC 27	Main Street/Leslie Campbell Road	0.97	7	2	N/A	13000	-----	13000	5100	5100	ADQ	60
Leslie Campbell Road (SR 2084)												
NC 27/Old Stage Road	Kivett Road/Stewart Camp Road	0.97	7	2	18	13000	-----	13000	8100	8100	ADQ	ADQ
Kivett Road/Stewart Camp Road	Old Church Road Extension	0.97	7	2	18	13000	-----	13000	7450	7450	ADQ	ADQ
Old Church Road Extension	Main Street/Marshbanks Road	0.24	7	2	18	13000	-----	13000	8400	8400	ADQ	ADQ
Main Street/Marshbanks Road	Judge Taylor Street	0.80	7	2	18	13000	-----	20500	12500	12500	H	ADQ
Judge Taylor Street	US 421/NC 27	0.24	9	2	18	13500	-----	20500	12500	12500	H	ADQ
Old Church Road Extension												
Main Street	Old Church Road	0.88	**********PROPOSED**********					13000	5000	5000	K	60
Kivett Road	Leslie Campbell Road	0.32	**********PROPOSED**********					13000	5000	5000	K	60

Appendix B

Thoroughfare Planning Principles

THOROUGHFARE PLANNING PRINCIPLES

The primary mission of thoroughfare planning is to assure that the road system will be progressively developed to serve future travel desires. Therefore, provisions are made for street and highway improvements so that when the need arises, feasible opportunities to make improvements exist.

Benefits of Thoroughfare Planning

The two major benefits derived from thoroughfare planning are: (1) the design of each road or highway to perform a specific function and provide a specific level of service, and (2) the reporting of future improvements to local officials for their possible incorporation into planning and policy decisions. Roads performing a specific function allows for savings in right-of-way, construction, and maintenance costs. Providing a specific level of service for roads allows for protection of residential neighborhoods and encouragement of stability in travel and land use patterns. Informing local officials of the thoroughfare plan:

(1) permits developers to design subdivisions in a non-conflicting manner,
(2) directs school & park officials to better locations of their facilities, and
(3) minimizes the damage to property values and community appearance sometimes associated with roadway improvements.

Thoroughfare Classification Systems

Streets give traffic service and land access to the public. The fact that streets combine these two functions together creates conflict due to the incompatibility of these functions. The conflict is not serious if both traffic and land service demands are low. High demands and uncontrolled, intensely developed abutting property, however, create intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets, permitting travel from origins to destinations with directness, ease and safety. Different streets in this system are designed and are essential to perform specific functions, thus minimizing the traffic and land service conflict.

Urban Classification

In the urban thoroughfare plan, elements are classified as major thoroughfares, minor thoroughfares, or local access streets.

Major Thoroughfares are the primary traffic arteries of the urban area providing for traffic movements within around, and through the area.
Minor Thoroughfares are designed to collect traffic from the local access streets and carry it to the major thoroughfare system.
Local Access Streets provide access to abutting property. Local streets may be further classified as either residential commercial and/or industrial depending upon the type of land use that they serve.

Idealized Major Thoroughfare System

The coordinated system of major thoroughfares that is most adaptable to the desired lines of travel within an urban area and that is reflected in most urban area thoroughfare plans is the radial-loop system. The radial-loop system includes radials, crosstowns, loops, and bypasses.

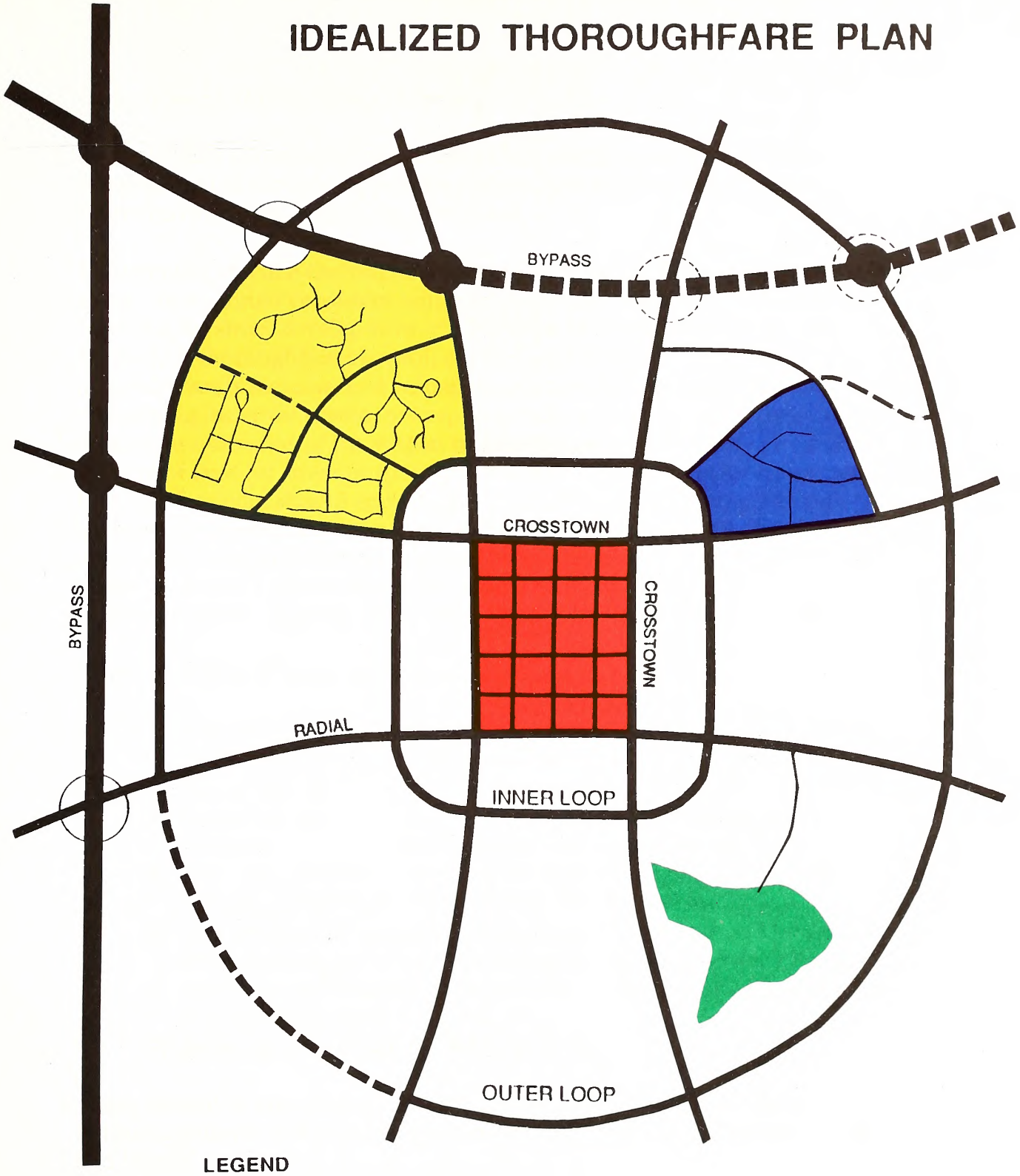
Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. A system of crosstown streets forming a loop around the central business district would avoid this problem. This system allows traffic moving from origins on one side of the central area to destinations on the other side to follow the area's border. It also allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a business or pedestrian shopping area.

Loop system streets move traffic between suburban area of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets can carry heavy volumes of traffic; their major function is to help relieve central areas. Depending on the size of the urban area, more than one loop street may be needed. If this is the case, the loop streets are generally spaced 1/2-mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic that has no desire to be in the city. Designed at through-highway standards, access to the bypasses are restricted. Some bypasses with low volumes can function as part of an urban loop. Bypasses are created to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area. Figure 10 shows an idealized thoroughfare plan map.

IDEALIZED THOROUGHFARE PLAN



LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE FREEWAY		
MAJOR OTHER		
MINOR THOROUGHFARE		
LOCAL ROAD		
INTERCHANGE		
GRADE SEPERATION		

LAND USES

- COMMERCIAL/BUSINESS
- RESIDENTIAL
- INDUSTRIAL
- PUBLIC/INSTITUTIONAL

FIGURE 10

Objectives of Thoroughfare Planning

Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system to meet the existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the street system in a manner consistent with changing traffic demands. Through proper planning for street development, costly errors and needless expense can be averted. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and help eliminate unnecessary improvements. By developing the street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained that will require a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present & future population and commercial & industrial enterprises, affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

1) Providing for the development of an adequate major street system as land development occurs;
2) Reducing travel and transportation costs;
3) Reducing the cost of major street improvements to the public through the coordination of street system with private action;
4) Enabling private interests to plan their action, improvements, and development with full knowledge of public intent;
5) Minimizing disruption and displacement of people and businesses through long range planning for major street improvements;
6) Reducing environmental impacts such as air pollution, resulting from transportation; and
7) Increasing travel safety.

These objectives are achieved through improving both the operational efficiency of thoroughfares, and improving the system efficiency by system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the ability of the street to carry vehicular traffic and people. In terms of vehicular traffic, a street's capacity is the maximum number of vehicles that can pass a point on a roadway

during a given period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include:

Street Widening: widening a street from two to four travel lanes at least doubles the capacity by providing additional maneuverability for traffic.
Intersection Improvements: the increase of the turning radii, the addition of exclusive turn lanes, and the channelization of movements improve the capacity of an existing intersection.
Improving vertical and horizontal alignment: this reduces the congestion caused by slow moving vehicles.
Eliminating roadside obstacles: this reduces side friction and improves a driver's field of sight.

Operational ways to improve street capacity include:

Control of access: a roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.
Parking relocation: Relocating on-street parking to an off-street site increases capacity by providing added street width for traffic flow and reducing friction to traffic flow caused by parking and unparking vehicles.
One-Way operation: the capacity of a street can be increased 20-50% (depending upon turning movements and street width), by initiating one-way traffic operations. One-way streets improve traffic flow by reducing potential traffic conflicts and simplifying traffic signal coordination.
Reversible Lanes: may be used to increase street capacity in situations where heavy directional flows occur during peak periods.
Signal phasing and coordination: uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Travel demand can be altered to improve the efficiency of existing streets by:

Carpools: use of carpools can reduce the number of vehicles on the roadway and raise the people-carrying capability of the street system.
Alternate mode: alternate travel modes (i.e., transit, bicycles) can be used.
Work hours: industries, businesses and institutions staggering work hours or creating variable work hours for employees will reduce travel demand in peak periods and spread peak travel over a longer period.
Land use: a more travel-efficient land use development or redevelopment should be encouraged.

System Efficiency

Another means of altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, system efficiency, function classification, and idealized major thoroughfare system are some tools available to the transportation planner to develop a thoroughfare plan. In truth, thoroughfare planning is done for existing urban areas and curbed by existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these and many other factors that affect major street locations.

Throughout the thoroughfare planning process, certain basic principles must be followed as closely as possible from a practical viewpoint. These principles are:

1) The plan should be derived from a thorough knowledge of today's travel, its features, and any contributing, limiting, or modifying factors.
2) Traffic demands must be sufficient to the kind and development of each major street. The thoroughfare plan should allow for a large portion of major traffic movements on a few streets.
3) The plan should adapt and cater to the area land development plan.
4) Urban development beyond the current planning period must be considered. In outlying or sparsely developed areas with development potential, thoroughfares must be denoted on a long-range planning basis to protect rights-of-way for future thoroughfare development.
5) While being consistent with the above principles and realistic with travel trends, the plan must be economically feasible.

Appendix C

Implementation Of The Thoroughfare Plan

Once the thoroughfare plan has been developed and adopted, implementation is essential. Unless implementation is an integral part of the thoroughfare plan process, the effort and expense associated with developing the plan is lost. There are several tools available for use by Harnett County to assist in the implementation of the thoroughfare plan for this area. They are listed below.

State-Municipal Adoption of the Thoroughfare Plan

If Harnett County had adopted the plan and the North Carolina Board of Transportation (NCDOT) would have mutually approved the thoroughfare plan shown in Figure 2, the mutually approved plan could have served as a guide for the Department of Transportation in the development of the road and highway system for the planning area. The approval for the plan by the Town would have enabled standard road regulations and land use controls to be used effectively in the incorporation of this plan. If the plan was adopted, the Town and Department of Transportation would have reached agreement on the responsibilities for existing and proposed streets and highways. State-maintained facilities will be constructed and maintained by the Divisions of Highways; municipal-maintained facilities will be constructed and maintained by the municipality.

To neglect the implementation process is a three-fold loss: the loss of the capital expenditures used in developing a plan, the opportunity cost of the capital expenditures, and more importantly, the loss of the benefits to accrue from an improved transportation system.

Subdivision Controls

Subdivision regulations require every subdivider to submit to the Town Planning Commission a plan of any proposed subdivision. The regulations also require that these areas be constructed to certain standards. Through this process, it is possible to require subdivision streets to conform to the thoroughfare plan and to reserve or protect necessary right-of-way for projected roads and highways that are to become part of the thoroughfare plan. The adequate construction of subdivision streets reduces maintenance costs and simplifies the transfer of streets to the State Highway System.

Projects in the Buies Creek area that could be implemented or protected by subdivision ordinances are the Main Street Widening, Main Street Bypass, and the Leslie Campbell Road Widening. Appendix F outlines the recommended subdivision design standards as they pertain to road construction.

Zoning Controls

A zoning ordinance can be beneficial to thoroughfare planning by designating appropriate locations of various land uses and allowable densities of residential development. This provides a degree of stability on which to make future traffic projections and to plan streets and highways.

Other benefits of a good zoning ordinance are: (1) the establishment of standards of development which will aid traffic operations on major thoroughfares; and (2) the minimization of strip commercial developments which creates traffic friction and increases the traffic accident potential.

The zoning ordinances of Harnett County will rule in the Buies Creek Area. These ordinances should be structured to control strip development along the roads. Any commercial development along US 421/NC 27, Leslie Campbell Road, and Main Street should be controlled by the County's ordinances.

Land Use Controls

Land use regulations help to regulate future land development and minimize undesirable development along roads and highways. The land use regulatory system can improve highway safety by encouraging off-street parking and sufficient setbacks to provide for adequate sight distances. Right-of-way cost dedications and reservations play major roles in the ultimate cost of many facilities. In few cases will the municipality be able to enjoy the benefits of highway improvement without some form of investment.

These regulations would be applicable to facilities that are recommended to be widened to multiple lanes, such as Main Street from Leslie Campbell Road to Old Church Road and Leslie Campbell Road from US 421/NC 27 to Main Street. Land use controls can help ensure that these facilities will maintain their intended capacities by regulating the types of land use that develop along the roads.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and the Traffic Engineering Branch of the North Carolina Department of Transportation. In addition, any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, or large industries) may be comprehensively studied by staff of the NCDOT Traffic Engineering Branch, Planning and Environmental Branch, and/or Roadway Design Unit. If done at an early stage, it is often possible to improve the accessibility of the growth area while preserving the integrity of the thoroughfare plan.

Increased development is expected along the proposed Main St Bypass route,

Gregory Circle, and Leslie Campbell Road. Use of development regulations can help control increasing traffic and congestion along these roads. Developers can also reserve or donate rights-of-way as a part of future thoroughfares. The developers for the Collins Park project have built their access road off of Oak Grove Road. This access road will be built to NC DOT standards and will become a part of the future Main Street Bypass.

Funding Sources

Capital Improvements Program (CIP)

A Capital Improvement Program for transportation is a long-range plan for spending money on street improvements, acquisition of rights-of-way and other improvements on the basis of projected revenues. Municipal funds should be available for construction of street improvements that are a municipal responsibility, right-of-way cost sharing on facilities designated as a Division of Highways responsibility, and advance purchase of right-of-way where such action is warranted. However, NC House Bill 1211 limits the role of municipalities to specific limits in project cost sharing.

Transportation Improvement Program (TIP)

NCDOT's Transportation Improvement Program is a document listing all major construction projects NCDOT plans for the next seven years. Similar to local CIP projects, TIP projects are matched with projected funding sources. Every two years when the TIP is updated, completed projects are removed, programmed projects are advanced, and, if funding is available, new projects are added.

During TIP public hearings, municipalities request projects to be included in the TIP. A Board of Transportation (NCBOT) member reviews project requests in a particular area of the state. The board member chooses projects to be included in the TIP based on their technical feasibility, need, and available funding. TIP Funds are available for highway construction, widening, bridge replacement projects, highway safety and bicycle projects, public transit projects, and railroad projects.

Industrial Access Funds

If an industry wishes to develop property that does not have access to a state-maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

Spot Safety Program

The Spot Safety Program is a state-funded program designed to provide rapid assistance for locations experiencing traffic operational or safety problems. This

program includes preparing work order requests for funding of relatively small and low cost safety projects that can be completed in a short period of time.

During the first few months of this year, a Safety Oversight Committee was formed by Secretary Tolson to ensure the highest priority projects are funded first. This committee makes all funding decisions, and there appears to be no specified maximum amount allowed per project. However, most projects are still ranging in the $75,000 or below category.

Some examples of Spot Safety projects are installing or revising traffic signals, improving roadway geometrics, and constructing left turn lanes. A two-phase traffic signal installation at the Main Street/Marshbanks Road/Leslie Campbell Road intersection will occur as a result of Spot Safety funding. Widening for an exclusive right turn from Main Street to Leslie Campbell Road shall also be constructed under the Spot Safety Project.

Small Urban Funds

Small Urban Funds are available to municipalities with qualifying projects. Requests for Small Urban Fund assistance should be directed to the NCBOT member or NCDOT Division Engineer for Division 6.

Powell Bill Program

The Powell Bill (General Statutes 136-41.1 through 136-41.3) allocates funds to qualified incorporated cities and towns for the maintenance, construction, and reconstruction of local streets that are the responsibility of the municipalities. Because Buies Creek is not incorporated, no Powell Bill Funds were allotted to this area in 1996.

The North Carolina Highway Trust Fund Law[C-1]

The Highway Trust Fund Law was established in 1989 as a 13.5-year plan with four major goals for North Carolina roads and highways. These goals are:

1) to complete the remaining 2,768 km (1,716 mi) of four-lane construction on the 5,800 km (3,600 mi) North Carolina Intrastate System.
2) to construct a multilane connector in Asheville and parts of multilane loops in Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem.
3) to supplement the secondary roads appropriation in order to pave, by 1999, 16,100 km (10,000 mi) of unpaved secondary roads carrying 50 or

[C-1] For more information on the Highway Trust Fund Law, contact the Program Development Branch of the NCDOT.

more vehicles per day, and all other unpaved secondary roads by 2006.
4) to supplement the Powell Bill Program.

In this planning period, the Buies Creek area should look forward to the paving of most, if not all, of its unpaved roads on the state-maintained system within the planning boundary. If the Buies Creek area becomes incorporated, they will have access to the Powell Bill Funds for any roads in need of paving that are within those town limits.

Appendix D

Environmental Concerns

Environmental considerations associated with highway construction have come to the forefront of the planning process. The legislation that dictates the necessary procedures regarding environmental impacts is the National Environmental Policy Act. Section 102 of this act requires the creation of an environmental impact statement (EIS) for road projects having a significant impact on the environment. Included in an EIS would be the project's impact on wetlands, water quality, historic properties, wildlife, and public lands. While this report does not cover the environmental concerns in as much detail as an EIS would, preliminary research was done on several of these factors and is included below.

Threatened and Endangered Species

The Threatened and Endangered Species Act of 1973 allows the US Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plants and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, we are able to avoid or minimize these impacts.

The North Carolina Department of Environment, Health, and Natural Resources (NC DEHNR) was the source of the name and type of each endangered species and natural area or community that existed in Harnett County and the Buies Creek Planning Boundary. There was only one plant and one animal identified as rare or significant in the area. The following is a list of the federally protected species and areas located in the Buies Creek area planning boundary.

<u>Rare animal</u>

Tadarida brasiliensis (Brazilian Free-Tailed Bat)

<u>Rare plants</u>

Nestronia umbellula (Nestronia---a flower whose cluster has the shape of an upside-down umbrella)

EF: seen as an endangered species by the State and Federal Governments. An endangered species is one "in danger of extinction throughout all or a significant portion of its range."[1]

E: seen as an endangered species by the State Government only.

TF: seen as a threatened species by the State and Federal Governments. A threatened species is one "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."[1]

T: seen as a threatened species by the State Government only.

([1]Definitions are taken from the *Federal Register*, Vol. 56, No. 225, November 1, 1991 (50 CFR Part 17).)

None of these endangered plants and animals will be affected by roads proposed to be built in this thoroughfare plan. Special care will be taken during the project planning stage of any project to insure the protection of any area.

There are other species in the Buies Creek Area that are significantly rare or of special concerns. These species may become threatened or endangered in the future and should be considered in subsequent planning studies.

Wetlands

In general terms, wetlands are areas where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. Water creates severe physiological problems for all plants and animals except those that are adapted for life in it or in saturated soil.

Wetlands are crucial ecosystems in our environment. They help regulate and maintain the hydrology of our rivers, lakes, and streams by slowly storing and releasing flood waters. They help maintain the quality of our water by erosion. They are also critical to fish and wildlife populations. Wetlands provided an important habitat for about one third of the land and animal species that are federally listed as threatened or endangered.

In this study, the impacts to wetlands were determined using the National Wetlands Inventory Mapping, available from the U.S. Fish and Wildlife Service.

Wetlands impacts should be avoided or minimized to the greatest extent possible while preserving the integrity of the transportation plan. The following is a list of the federally and state protected areas located in the Buies Creek Area planning boundary.

<u>Endangered natural communities</u>

- Floodplain pool
- Basic Mesic Forest
- Piedmont/Mountain Levee Forest
- Raven Rock State Park and Vicinity
- Neills Creek Aquatic Habitat
- Harnett Sunfacing Coneflower Site

Historic Sites

The locations of historic sites in the Buies Creek area were investigated to determine the possible impacts of the proposed transportation improvements. The federal government requires all State Departments of Transportation to make special efforts to preserve historic sites. Section 106 of the National Historic Preservations Act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The

efforts to preserve historic sites. Section 106 of the National Historic Preservations Act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The NC DOT must consider the impact of its road projects on these properties and consult with the Federal Advisory Council on Historic Preservation.

In addition to federal guidelines, the State of North Carolina has issued its own guidelines for historic site preservation. The NC General Stature 121-12(a) requires the NC DOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. NC DOT must consider impacts and consult with the NC Historical Commission, but it is not bound by their recommendations.

A representative of the NC Department of Cultural Resources found only two buildings in the planning area that are or possibly are registered in the National Register of Historic Places: the James Archibald Campbell House, and Kivett Hall of Campbell University. Kivett Hall is located in a quad of the campus, and is not located off of a thoroughfare. The Campbell House is located at the intersection of US 421/NC 27 and Johnson Farm Road. Neither of these properties should be affected by the thoroughfare plan.

Appendix E

Public Involvement

One of the goals of a thoroughfare plan is to conduct a study that (1) uses comprehensive and complete information, (2) is a never-ending or continuing process, and (3) shows cooperation with the town agencies and public. This appendix shows discussions with Harnett County agencies, Campbell University and the public to determine issues of importance to them.

Meetings

On September 8, 1994, Campbell University requested NCDOT to conduct an update study of the Thoroughfare Plan for the Buies Creek area.

From 1995 to the present, members of Campbell University, Harnett County Government, and the public have been contacted by the NCDOT Statewide Planning Branch to discuss the thoroughfare planning process and any recommendations that were needed for the Buies Creek Planning Area.

Several meetings were held with Harnett County Planners and Campbell University. Many issues were discussed, including the following:

1) construction and location of a Convocation Center on the campus of Campbell University
2) accidents occurring and possible signal installation at Main Street/ Marshbanks Road/Leslie Campbell Road intersection
3) possible closing of Davis Street (SR 1573) to create a pedestrian plaza at the Fine Arts Building
4) the 2nd construction phase of the Keith Hills Country Club, to include small zones of both the Lillington & Buies Creek Planning Areas.

On March 3, 1997, NCDOT introduced the thoroughfare planning process at a Harnett County Planning Board meeting, along with an overview of the proposed steps in the plan's development and a discussion of the various public involvement opportunities that are available for use. At another Planning Board Meeting, a recommendation of a proposed route (Gregory Circle Connector) that traverses southwest from Gregory Circle (SR 1521) to intersect with Johnson Farm Road (SR 1542) approximately 0.3 mi north of the US 421/NC 27/Johnson Farm Road intersection was added to the thoroughfare plan to help alleviate traffic along Main Street. However, this connector and the NC 27 Bypass were later removed due to objections from the public (e.g., that the route would traverse through someone's house/land, the route was not justified in reducing Main Street or NC 27 traffic). The Planning Board came to a consensus to approve the Proposed Thoroughfare Plan to be presented to the Harnett County Board of Commissioners in July 1997. The recommendations are listed under the discussion conducted with the Harnett County Board of Commissioners.

From discussions and analyses of the transportation system in the county, a set of preliminary recommendations were developed. On August 18, 1997, NCDOT introduced the thoroughfare planning process to the Harnett County Board of

Commissioners and presented a preliminary version of the thoroughfare plan for the county. The major projects proposed at this meeting were:

1) Widening of Leslie Campbell Road (SR 2084) to provide for a center lane from US 421/NC 27 to Main Street/Marshbanks Road/Leslie Campbell Road intersection due to projected congestion
2) Signal installation at Main Street/Marshbanks Road/Leslie Campbell Rd) intersection due to accident occurrence
3) New minor thoroughfare (Main Street Bypass) to be built 0.1 mi south of the Main Street/Mitchell Road intersection, continuing south to Old Church Road twice, traversing the southbound leg of Old Church Road, and ending at an intersection with Leslie Campbell Road. This bypass will help alleviate the capacity deficiency of Main Street by rerouting any traffic bound for the eastern campus side.
4) Widening of Main Street (SR 1532) to accommodate a center lane from Leslie Campbell Road to 0.1 mi north of Old Church Road. One section from 0.1 mi north of Leslie Campbell Road to School Loop Road (SR 1531) will be striped for three lanes due to its existing width.

The town officials and public agreed on most of the projects proposed. However, there were several additional requests and concerns brought out by local officials. These included the following (followed by *responses*):

1) Widening of Main Street to accommodate a center lane. Members of the Public and the Board of Commissioners were concerned with how the widening was going to affect the homes and businesses existing along the road (some of these buildings sit within 10 feet of the edge of pavement). *Some relocations would be necessary to accommodate the widening, but only where it is necessary.*
2) Signal installation at Main Street/Marshbanks Road/Leslie Campbell Rd intersection. Members were concerned how soon the installation would occur. *In discussion of the installation with the NCDOT Area Traffic Engineering Office, they recommended the signal installation. The funding would be included in the widening recommendation of Leslie Campbell Road. The public and the Board of Commissioners would have to discuss the funding and time of the project with the Division Engineer.*
3) Proposed minor thoroughfare to help alleviate the capacity deficiency of Main Street. Members were concerned about the need for the new route. *This route is needed to relieve the traffic along Main Street, especially during the open school sessions. Without it, Main Street may face additional improvements other than the minimal improvements recommended previously. Such improvements may have a more adverse impact than those currently perceived for the connector. This routing would have the least impact on the area and do the most benefit for the area simultaneously.*
   Members were also concerned what improvements would be needed if the new route was not built.
   Additional relocations would be necessary if five lanes were built instead of three.

Public Workshops/Hearings
On August 7, 1996, a Public Workshop was held at the Buies Creek Elementary School to gather ideas and opinions from the public. Twenty-two people attended the workshop. From discussions with the Harnett County Planners and analyses of the transportation system in the county, a set of preliminary recommendations were developed and presented at the workshop. These improvements included the following (followed by public reaction and *responses*):

1) Widening of Leslie Campbell Road (SR 2084) from Main Street/ Marshbanks Rd/Leslie Campbell Rd intersection to Judge Taylor Street (SR 1524) to allow for a center lane to facilitate movement of traffic through this section of Leslie Campbell Road.
2) A proposed route from the Main Street/Mitchell Road intersection, intersecting the sharp curve of Old Church Road (SR 1533), traversing along the southbound leg of Old Church Road, and ending at an intersection with Leslie Campbell Road to facilitate traffic movement through the Buies Creek area and lessen congestion on Main Street within the campus.
3) A proposed route traversing northwest from the US 421/NC 27/ Marshbanks Road intersection and turning to end at a 90-degree angle at the NC 27/McLamb Road intersection to facilitate movement of NC 27 traffic (NC 27 Bypass).
4) Widening of Main Street (SR 1532) to accommodate a center lane from Leslie Campbell Road (SR 2084) to 0.1 mi north of Old Church Road. This should help alleviate congestion along Main Street.

Most of the attendees were concerned with the widening of Main Street, due to the impact the widening would have on the buildings existing along the route. *Some relocations would be necessary to accommodate the widening, but only where it is necessary.*

Some of the attendees were also concerned about signal installation at the Main Street/Marshbanks Road/Leslie Campbell Road intersection, due to the accidents they had either seen or heard about occurring at this location. *NCDOT would investigate the accidents occurring at this intersection further.*

Conversations with the Public
Many members of the public expressed their concerns for designs of proposed roads. The thoroughfare planning process was explained by letter or by phone, as well as information from the August 1996 Public Workshop and traffic volume study on the routes within the planning boundary. The recommended thoroughfare plan addresses these concerns. **A summary of concerns are listed below:**

1) Concerns about the NC 27 Bypass proposal
2) Concerns about the Gregory Circle Connector
3) Concerns about the Main Street Bypass proposal.

Appendix F

Recommended Definitions and Design Standards for Subdivision Ordinances

Definitions

Streets and Roads

Rural Roads

1. Principal Arterial: A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.
2. Minor Arterial: A rural roadway joining cities and larger towns and providing intrastate and inter-county service at relatively high overall travel speeds with minimum interference to through movement.
3. Major Collector: A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.
4. Minor Collector: A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.
5. Local Road: A road which serves primarily to provide access to adjacent land, over relatively short distances.

Urban Streets

1. Major Thoroughfares: Those thoroughfares consisting of Interstate, Intrastate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.
2. Minor Thoroughfares: Those thoroughfares that perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.
3. Local Street: Any street not on a higher order urban system that serves primarily to provide direct access to abutting land.

Specific Type Rural or Urban Streets

1. Freeway, Expressway, or Parkway: Divided multilane highways designed to carry large volumes of traffic at higher speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally one with grade separations at major intersections. A parkway is for non-commercial traffic, with full or partial control of access.
2. Residential Collector Street: A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collects traffic from 100 to 400 dwelling units.
3. Local Residential Street: Cul-de-sacs, loop streets less than 750 m in length, or streets less than 1.5 km in length that do not connect thoroughfares, or serve

major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. Cul-de sac: A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.
5. Frontage Road: A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.
6. Alley: A strip of land, owned publicly or privately, set aside primarily for vehicular service access to back sides of properties otherwise abutting on a st.

Property

Building Setback Line

A line parallel to the street in front of which no structure shall be erected.

Easement

A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

Lot

A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

Subdivision

Subdivider

Any person, firm, corporation or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

Subdivision

All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose (immediate or future) of sale or building development and all divisions of land involving the dedication of a new street of change in existing streets. The following shall not be included within this definition not subject to these regulations:

1) The combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein.
2) the division of land into parcels greater than four hectares where no street ROW dedication is involved
3) the public acquisition (by purchase) of strips of land for the widening or the opening of streets
4) the division of a tract in single ownership whose entire area is no

greater than 0.8 hectares into not more than three lots, where no street ROW dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

Dedication
A gift, by the owner, of his property to another party without any considerations being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

Reservation
Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

Streets and Roads

The design of all roads within the Buies Creek area shall be in accordance with the accepted policies of the NCDOT, Department of Planning and Environmental as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street ROW shall conform and meet the recommendations of the Thoroughfare Plan. The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally, the proposed streets should be the extension of existing streets if possible.

Right-of-way Widths
ROW widths shall not be less than those shown in Table 6 and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

The subdivider will only be required to dedicate a maximum of 30 meters of ROW. In cases where the desired ROW is more than 30 meters, the subdivider will be required only to reserve the amount in excess of 30 m. In all cases in which ROW is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width ROW (not less than 18 m in width) may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required ROW shall be dedicated.

Table 6
Minimum Right-of-Way Requirements

Area Classification	Functional Classification	Minimum ROW(m)
Rural	Principal Arterial	Freeways: 105
		Other: 60
	Minor Arterial	30
	Major Collector	30
	Minor Collector	24
	Local Road[1]	18
Urban	Major Thoroughfare	27
	Minor Thoroughfare	21
	Local Street[1]	18
	Cul-de-Sac[2]	Variable

[1]The desirable minimum ROW is 18.3 m. If curb and gutter are provided, 15 m of ROW is adequate on local residential streets.
[2]The ROW dimension will depend on radius used for vehicular turnaround. Distance from edge of pavement of turnaround to ROW should not be less than distance from edge of pavement to ROW on street approaching turnaround.

Street Widths
Street and road classification widths other than local shall be as the Thoroughfare Plan recommends. Local roads and streets width shall be as follows:

1) Local Residential
Curb-and-gutter section: 7.9 m, face to face of curb
Shoulder section: 6.1 m to edge of pavement, 1.2 m for shoulders

2) *Residential Collector*
Curb-and-gutter section: 10.4 m, face to face of curb
Shoulder section: 6.1 m to edge of pavement, 1.8 m for shoulders

Geometric Characteristics
The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under ROW shall apply.

1) *Design Speed*: The design speed for a roadway should be a minimum of 10 kph (5 mph) greater than the posted speed limit.

Table 7
Design Speeds (in kph)

Facility Type	Desirable Speed	Minimum Speed	
		Level	Rolling
Rural Roads			
Minor Collector	100	81	65
Local[1]	80	81	65
Urban Roads			
Major Thoroughfare[2]	100	81	65
Minor Thoroughfare	100	81	65
Local Street	65	65	48

2) *Maximum and Minimum Grades*:
   a) The maximum grades in percent are shown in the following table.
   b) Minimum grade should not be less than 0.5%.
   c) Grades for 30 meters each way from intersections (measured from edge of pavement) should not exceed 5%.
   d) For streets and roads with projected annual average daily traffic less than 250 vpd, short grades (less than 152 meters in length) may be 150% of the value in Table 8.

Table 8
Maximum Vertical Grade

Facility Type	Design Speed (kph)	Minimum Grade in Percent		
		Flat	Rolling	Mountainous
Rural				
Minor Collector Rds[1]	30	7	10	12
	50	7	9	10
	65	7	8	10
	80	6	7	9
	100	5	6	8
	110	4	5	6
Local Roads[1,2]	30	N/A	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	N/A
Urban				
Major Thoroughfares[3]	50	8	9	11
	65	7	8	10
	80	6	7	9
	100	5	6	8
Minor Thoroughfares[1]	30	9	12	14
	50	9	11	12
	65	9	10	12
	80	7	8	10
	100	6	7	9
	110	5	6	7
Local Streets[1]	30	N/A	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	N/A

[1]For streets and roads with projected annual average daily traffic less than 250 vpd or short grades less than 150 meters, grades may be 2% steeper than the values shown in Table 8. (Reference: NCDOT Roadway Metric Design Manual, page 1-12, T-3)
[2]Local Roads include Residential Collectors and Local Residential.
[3]Major Thoroughfares other than Freeways or Expressways.

3) *Minimum Sight Distance*: In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the parameters shown in Table 9.

Table 9
Sight Distances

Design Speed (kph)	50	65	80	100
Stopping Sight Distance				
Minimum	61	84	122	160
Desirable Minimum	61	99	145	198
Minimum K[1] Value for:				
Crest Curve	9	24	49	95
Sag Curve	12	21	34	49

Note: General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case.
Minimum passing distance for a 2-lane road is currently under revision.
(Reference: NCDOT Roadway Metric Design Manual page 1-12, T-1)
[1]K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in meters (in feet) of the vertical curve which will provide the desired sight distance.

4) *Superelevation*: Table 10 shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter of 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

Table 10
Superelevation Table

Design Speed (kph)	**Minimum Radius of Maximum e[1]**		
	e = 0.04	**e = 0.06**	**e = 0.08**
50	100	90	80
65	175	160	145
80	280	250	230
100	490	435	395

[1]e = rate of roadway superelevation, m/m (ft/ft)
Reference: NCDOT Roadway Design Manual, page 1-12, T-6 through T-8

Intersections

1) Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.
2) Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.
3) Offset intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters between survey centerlines.

Cul-de-Sacs

Cul-de-sacs shall not be more than one-hundred fifty (150) meters in length. The distance from the edge of pavement on the vehicular turnaround to the ROW line should not be less than the distance from the edge of pavement to ROW line on the street approaching the turnaround. Cul-de-sacs should not be used to avoid connection with an existing street or avoid the extension of an important street.

Alleys

1) Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provision is made for service access. Alleys shall not be provided in residential subdivision unless necessitated by unusual circumstances.
2) The width of an alley shall be at least 6.0 meters.
3) Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turnaround facilities at the dead-end as may be required by the Planning Board.

Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the NCDOT.

Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9.0 meters from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters from the face of curb.

Wheelchair Ramps
All street curbs being constructed or reconstructed for maintenance purposes, traffic operations repairs correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided an at other major points of pedestrian flow.

Horizontal Width on Bridge Deck
The clear roadway widths for new and reconstructed bridges serving 2-lane, 2-way traffic should be as follows:

1) Shoulder section approach:
   a) Under 800 ADT design year; minimum 8.5 m width, face to face of parapets of rails or pavement width plus 3.1 m, whichever greater.
   b) 800-2000 ADT design year; minimum 10.4 m width, face to face of parapets of rails or pavement width plus 3.7 m, whichever greater.
   c) Over 2000 ADT design year; minimum width of 12.2 m, desirable width of 13.4 m width, face to face to parapets or rails.
2) Curbs and gutter approach
   a) Under 800 ADT design year; minimum 7.3 m face to face of curbs.
   b) Over 800 ADT design year; width of approach pavement measured face to face of curbs. Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be 0.5 m minimum, or greater if sidewalks are required.
3) The clear roadway widths for new and reconstructed bridges having 4 or more lanes servicing undivided two-way traffic should be as follows:
   a) Shoulder section approach: Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 2.4 m minimum, 3.1 m desirable.)
   b) Curb and gutter approach: Width of approach pavement measured face to face of curbs.

Table 11
Exact Metric Equivalents

English Units	Metric Units
1 inch	equals 2.54 centimeters (cm)
1 foot	equals 0.30 meters (m)
1 mile	equals 1.61 kilometers (km)
1 acre[1]	equals 0.40 hectares (ha)

[1]1 acre = 43,560 ft^2

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Table 12
Exact English Equivalents

Metric Units	English Units
1 centimeter (cm)	equals 0.39 inches
1 meter (m)	equals 3.28 feet
1 kilometer (km)	equals 0.62 miles
1 hectare (ha)	equals 2.47 acres

Table 13
NCDOT Metric Roadway Conversions

Lane	Widths	Shoulder	Widths
8 feet	2.4 m	1 foot	0.3 m
9 feet	2.7 m	2 feet	0.6 m
10 feet	3.0 m	4 feet	1.2 m
11 feet	3.3 m	6 feet	1.8 m
12 feet	3.6 m	8 feet	2.4 m
14 feet	4.2 m		